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ABSTRACT

Three studies investigated some variables involved in the psychological processes related to instruction. One study looked at the influence of notetaking, length of the listening-study interval, and thematic organization of the lecture on recall. It found that more ideas were recalled when notes were taken than when notetaking was not permitted and that more ideas were recalled when the material was on different topics than when the material was all related to the same topic. A second study compared the imposition of a subordinate strategy which was incongruent with the passage organization to a condition in which both passage organization and clustering strategy were congruent. A main finding was that incongruence between passage organization and clustering strategy resulted in more recall than congruence. The third study looked at the effect of recitation on retention in relation to individual reactions to stress. The findings showed that impromptu responding and oral presentation from notes rather than the reading of reports prepared by students is preferable for students whose learning is debilitated by stressful situations. (JY)

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ORGANIZATION OF MATERIALS AND THE LEARNER's INSTRUMENTAL ACTIVITIES.

Section II, Instructional Strategies: Multivariable Studies of Psychological Processes Related to Instruction

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Summary

Listening and Note-taking II: Thematic Content, Note-Taking, and Length of Listening Review Intervals as Variables Influencing Immediate and Delayed Recall*

Francis J. Di Vesta and G. Susan Gray

Technical Problem

This study was based on the consideration that the recall of material from a lecture may be influenced by three variables: note-taking, length of the listening-study interval, and thematic organization (i.e., relatedness of the content of the lecture). Underlying these operations were assumed to be the facilitative functions of external storage and transformation of material served by note-taking; consolidation of material by frequent interruptions during which the learning could "mature"; and, linking of the new material to previously learned material when the content was related.

General Methodology

The subjects were presented a 30-minute passage via a recording. Passages were broken into 5-minute segments each of which contained the same number of words and ideas. The contents of these segments were either all related to a common theme; related to a common theme but on different topics; or on completely different topics. These variations

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* This is a preliminary report. Other analyses being made of the data were not completed at the time the technical report was being prepared.

were completely crossed with three variations of listen-study intervals (i.e., 5-minute - 2 minute; 15-minute - 6 minute, and 30-minute - 12 minute combinations) and two variations of note-taking (i.e., note-taking permitted or note-taking not permitted).

Technical Results

The findings indicated that note-taking and thematic relatedness were related to the ability of subjects to recall material to which they had listened. More ideas were recalled when notes were taken than when note-taking was not permitted and more ideas were recalled when the material was on different topics than when the material was all related to the same topic. These effects were especially noted on a delayed recall test administered one week following the listening period. One interpretation of the finding that more is remembered from the discontinuous material is that less opportunity for interference exists in such material than it does in continuously related content. No effects were found due to variations in the listening-study intervals or the interaction between the treatments and the memory-span (i.e., the individual difference variable.)

Educational Implications

As Crawford (1925) had indicated in his study, it was also found in the present study that the immediate value of notes appears to be of less value than the delayed value. Notes appear to increase the saliency of given ideas and make them more subject to recall, though not necessarily guaranteeing that they will be recalled. These studies point clearly in the direction that note-taking acts more as a transformational aid for the student than as a mere external storage mechanism.

The findings regarding better recall of discontinuous material suggests that interruptions in ideas presented during a lecture might be beneficial. Stated somewhat differently, a lecturer might segment a lecture period by providing opportunity for discriminability among ideas presented, even though such ideas are distinctly related.

Implications for Further Research

The finding regarding the effect of thematic relatedness requires replication. Even though this finding parallels others found by Anderson & Carter (1971) it appears desirable that still other materials should be employed. One difficulty in conducting research with connected discourse is in equating all passages for such characteristics as familiarity and meaningfulness. An alternative, of course, is to randomize passages. Variations in content can also be accomplished by changing the degree of discriminability from one treatment to another as implied in the aforegoing section. Finally, it is suggested that future investigations of note-taking should be based on an analysis of the processes or strategies underlying this device much as has been done in Project Ikon (see Table of Contents for page numbers).

References

Anderson, R. C., & Carter, J. Retroactive inhibition of meaningfully-learned sentences. Mimeographed technical report, University of Illinois, 1971.

Crawford, C. C. Some experimental studies of the results of college note-taking. Journal of Educational Research, 1925, 12, 379-386.

Listening and Note-taking II: The Effects of Variations in Thematic Continuity, Note-taking, and Length of Listening-Review Intervals on Immediate and Delayed Recall*

Francis J. Di Vesta and G. Susan Gray

In a previous study by Di Vesta and Gray (1971) it was found that the number of ideas recalled by subjects after listening to a short passage was favorably influenced by note-taking, by rehearsal immediately after listening to a passage, and by testing on the passage. In comparison a study by Eisner & Rohde (1959) led to the conclusion that taking notes during a 3-min. lecture is not superior to delayed note-taking (i.e., note-taking immediately after the lecture). However, the differences between results of the two studies can easily be attributed to the consequence of procedural differences. Thus, for example, Eisner & Rohde had some subjects take notes and then study them immediately after listening while other subjects were to concentrate on the lecture and then jot down as many notes as they could, immediately after listening. In the Di Vesta & Gray study the subjects in one treatment used the rehearsal period to study their notes, or to contemplate what they had heard, and in another treatment they were prevented from rehearsing the material.

An analysis of the aforementioned studies together with more subjective considerations of the note-taking process suggests two other variables that may affect recall of material when notes are being taken

during a lecture: the length of a consolidation period and the degree of thematic organization of material presented in the lecture.

A consolidation period has been suggested by M. A. Howe (1970) and Hebb (1966) as a period during which the material can be rehearsed or coded for more efficient storage in memory. More specifically, Hebb (1966, pp. 122-123) suggests that "... newly acquired learning must be undisturbed for some time if it is to last ... and must be allowed to mature ... between 15 minutes and an hour or thereabouts." He speculates, too, that reinforcement may strengthen learning because it provides for a period during which consolidation can occur. On the basis of such assumptions it would appear that there are several opportunities during presentation of a lecture for providing a consolidation period. Thus, the lecturer himself, may pause to allow the material to "sink-in" or note-taking as an activity may function to direct the student's attention to certain parts of the material, perhaps at the expense of attention to other parts, but in the process allowing the important points to "mature". The most salient opportunity for consolidation may be a period immediately following a lecture during which time the student can review and contemplate all that had been said.

A somewhat neglected variable that appears to account for differences in procedures among studies on note-taking is what the present investigators have called the "thematic relatedness" of the lecture contents. Eisner & Rohde (1959) gave their subjects a 30-min. lecture on the short story and another on romanticism, each of which could be considered as self-contained passages on a single theme. Crawford (1925a; 1925b) employed a series of lectures in a college course; again these were probably more thematically related than not,

although his descriptions do not permit a precise evaluation. Berliner (1970) used a 30-min. passage comprised of thematically related material in the sense that it described the history of China but could also be considered as segmented because it described several independent aspects (e.g., dynasties, mongols, kingdoms, and rebellions) of China's development. Di Vesta & Gray (1971) used three 5-min. passages each completely independent of the others. Obviously, then, thematic relatedness of the content involved in the passages to which the subjects listened differed among studies. The implication of such differences is that thematic relatedness may have an effect on the strategy the student uses to store the material during learning and his ability to recall it on a later occasion. It may also have an effect on recall either through proactive or retroactive inhibition (Wickens, 1970) or through the possibilities for organization of the passage. Ausubel (1968) has been a leading advocate of improving didactic methods of instruction through increasing meaningfulness for the learner. Such considerations imply that the period prior to consolidation should be filled with material characterized by a minimal degree of meaningfulness to permit coding. While the criterion by which meaningfulness is defined must necessarily remain vague until its characteristics can be more fully specified, the present investigators assumed that thematic relationship may be one such characteristic.

Another consideration, of importance in an analysis of note-taking, is the number of ideas presented sequentially prior to a consolidation period. It can be argued that, because of the limitations of short-term memory, a lecture that contains too many ideas in a single sequence (which would be comparable to massed practice) would be difficult to

retain since there would be insufficient time for encoding (organizing) the material. A presentation (lecture) that was too long would also create difficulty for the learner because the material could not be rehearsed; it would not remain in short-term memory long enough to be encoded. Either situation would result in inefficient recall or retrieval, especially over the long-term.

In view of the aforegoing rationale, the present study was designed to extend previous studies on note-taking and listening by investigating the effects of thematic relatedness and of opportunity for consolidation on the learner's recall. Note-taking was incorporated into the design to provide continuity with earlier experiments and to determine whether note-taking interacts with the other variables.

In view of the fact that the present study emphasized memorial processes, it was assumed that individual differences in either coding ability or short-term memory would interact with the treatments considered. Due to limitations on time that could be demanded from subjects who participated in this study, both measures could not be administered. Accordingly, as an initial attempt at investigating aptitude by treatment interactions, it was decided to employ only a test of short-term memory on the reasoning that students with low short-term memory scores would have developed a strategy of taking notes as a way of compensating for their limited memory span. It was hypothesized that such persons would profit by taking notes, especially with an opportunity for review, and would be handicapped if prevented from doing so, especially without an opportunity for review, to a greater extent than would persons with higher short-term memory scores.

Experiment I

Method

Design. The subjects were randomly assigned to one of 18 conditions represented in a design consisting of three orthogonally crossed variables. The variables consisted of three levels of thematic relatedness, three variations of listen-study intervals, and two alternatives for note-taking.

Each thirty minute lecture to which the subjects listened was comprised of 5-min. segments. To achieve different levels of thematic relatedness, the degree to which the six 5-min. segments were associated to a common topic was varied. In the continuous related thematic (CRT) condition, the topic of the 30-min. passage was an historical narrative, segmented at 5-min. intervals. In the condition where the material was discontinuous but related by a common theme, each 5-min. passage covered a distinctly different topic, but the six topics were conceptually related to a superordinate idea (Condition DRT). The third treatment was called discontinuous-unrelated (DUR) since it was comprised of six passages whose topics were completely unrelated to one another.

Each of the three 30-min. thematic conditions, being separable into 5-min. segments, were manipulated to achieve 5-min., 15-min., and 30-min. variations in the length of the listening interval. In one variation of the listen-study interval, each 5-min. segment was followed by a 2-min. study interval, until all six segments had been presented. In the second variation, three of the 5-min. segments were presented consecutively, followed by a 6-min. study period, thereby

resulting in two sequences consisting of a 15-min. listening period followed by a 6-min. study period. The third variation of the listen-study interval consisted of the consecutive presentation of all six 5-min. passages, producing a 30-min. listening period, followed by a 12-min. study period. Thus, all groups had equal amounts of listening and study time. In a sense, these treatments were comparable to variations in massed and distributed practice.

The third set of treatments consisted of variations in the opportunity to take notes. Half of the subjects were provided with a booklet in which to take notes while listening to the passages; the other half of the subjects were instructed that they could not take notes. Consequently, during the study intervals, those subjects who took notes, could study their notes at this time. Subjects who were prohibited from taking notes used the study interval for mental rehearsal and recapitulation of the material to which they had listened.

Materials. The material for the continuous-theme was edited from Rachel Carson's Silent Spring (1962). The topic traced the history of the fire ant in the United States. In the DRT treatment, each of the six passages dealt with a distinct topic, a specific insecticide. Thus, while each 5-min. segment was an entity by itself, thematic relatedness was achieved by the inclusion of the topics of the six passages within the superordinate conceptual category of insecticides. The textual material was also edited from Carson (1962). The six segments of connected discourse employed in the DUR treatment dealt with six completely unrelated topics: the Chou dynasty in China (edited from Berliner, 1970); prison classification systems (Loveland,

1962); the Minnesota Theater (The Washington Post, 1970); and the insecticide, DDT (from Carson, 1962).

Each passage was constructed to meet as closely as possible the specifications of 500 words and 25 ideas. A separate tape was prepared for each of the three passages. The three different listen-study intervals were presented on separate tracks of each tape which was stored in the control room of a remote-deck library system language laboratory. The subjects, seated at individual booths in the language laboratory, could reach the tape to which they were assigned by means of a telephone dial.

Specific instructions were typed on bond paper and set on the desk in front of each subjects. If the subject was allowed to take notes, he was supplied with a booklet of note paper, one page for each of the six passages.

Subjects. The 90 subjects were volunteers for the experiment from an introductory educational psychology course at The Pennsylvania State University. They received credit toward their final grade in the course for their participation. None of the subjects had participated in an experiment requiring performance with connected discourse materials though most had participated in another experiment.

Procedure. A maximum of nine and a minimum of four subjects participated in the experiment during any one experimental session. The number of subjects varied because some subjects failed to appear at their assigned time. The subjects were randomly assigned to one of the 18 experimental conditions with the restriction that only one subject be placed in any one experimental cell during a single experimental session.

An additional restriction was imposed on the randomization procedure to assure that an equal number of subjects (n = 5) would be obtained for each cell.

When the subjects were seated in the experimental room the experimenter explained that the study was an attempt to investigate how students went about learning new materials. The operation of the laboratory equipment was also explained to the subjects at this time. After all questions were answered, the subjects put on their headphones and dialed the appropriate tape. When all were dialed in, the experimenter proceeded to the control room where the tapes were then started. After the last study period, the subjects were administered a free-recall test, followed by a 30 item true-false test on the material to which they had listened. For the free-recall test, the experimenter instructed the subjects to write down all they could remember about each passage in twenty minutes. They were told to use a separate page of the test booklet for each passage, but were also told that they could write on the passages in any order they wished--they did not have to follow the actual presentation order of the passages on the tapes. Following the 20 minute free-recall test period the subjects were administered the true-false tests.

One week after the initial experimental session, all subjects returned to take a 115 question true-false test, which included the 30 true-false test items comprising the initial test, and a memory span test patterned after Peterson and Peterson's short term memory task (1957).

Results

Separate 3 x 3 x 2 factorial analyses of variance were made of the number of ideas recalled in the free-recall task, the number of correct responses on the 30 item true-false test given immediately after the listening session, and the number of correct responses on the delayed true-false test.

The analysis of the number of ideas yielded F (2,72) = 24.42, $p < .001$ for the effect due to the passage organization. The subjects remembered fewer ideas from the CRT material ($\bar{X}$ = 27.33) than they did from the DRT material ($\bar{X}$ = 30.83). The greatest number of ideas was recalled ($\bar{X}$ = 43.20) by subjects who listened to the DUR material. Thus, the number of ideas recalled was influenced significantly by the thematic organization of the material. These results imply that recall was inversely related to the degree of thematic organization of the passages.

The effect due to the note-taking treatment yielded F (1,72) = 12.59, $p < .001$. The subjects who were not allowed to take notes recalled an average of 30.33 ideas whereas the subjects who were allowed to take notes while listening recalled an average of 37.24 ideas.

None of the treatments significantly affected the subjects' performance on the immediate true-false test. However, the analysis of the scores for the delayed true-false test, given one week after the experimental session, yielded F (1,72) = 8.40, $p < .005$ for the effect due to the note-taking treatment. Those subjects who were allowed to take notes achieved a mean score of 84.69 on the 115-item test, while subjects

who took no notes achieved a mean score of 79.16. Although definite conclusions regarding functional relationships cannot be drawn from these data because of the differences in lengths, with consequent differences on reliability, of the immediate and delayed test, the data imply that performance on the delayed test was affected by the taking of notes.

Experiment II

The design used in Experiment I was extended in Experiment II by the addition of a fourth treatment to the thematic relatedness variable. The textual material for this treatment was identical to that incorporated in the continuous-related theme (condition CRT) in Experiment I, i.e., the history of the fire-ant (Carson, 1962). However, the material was not presented according to the logical and chronological order employed in Experiment I. Instead, the six segments were scrambled such that the 5-min. passage that was originally presented in the fourth position was presented first, followed by passages 2, 5, 1, 6, and 3, respectively. In addition, two forms of the true-false test were administered, one to half of the experimental groups and the other to the remaining groups, immediately after listening. The addition of the continuous-scrambled thematic (CST) treatment and the two forms of the true-false test resulted in an experimental design with four orthogonally crossed variables: four variations of thematic relatedness; three variations of length of listening interval; two note-taking treatments; and two forms of the test administered immediately after listening.

Method

Materials. The same materials were used as in Experiment I. A fourth tape was prepared for the continuous-scrambled theme, with three tracks for the three listen-study intervals, respectively.

Subjects. The subjects for this Experiment II were 240 students from another class of the introductory course in educational psychology. In all other respects their characteristics were essentially the same as those employed in Experiment I.

Procedure. The procedures for Experiment II were identical to those followed in Experiment I, except that the subjects in Experiment II were allowed as much time as they needed for the free-recall task. However, they were instructed that once they had begun the true-false test they could not return to the free-recall test.

As in Experiment I, all subjects returned one week after the experimental session to take the 115-item true-false test and the memory span test.

Results

In this experiment the free-recall material was scored for the number of ideas correctly recalled and the total number of words recalled. Each of these scores was separately analyzed by a 4 x 3 x 2 x 6 mixed analysis of variance in which the last variable was a within-subjects variable consisting of the six passages. The scores based on the true-false tests were analyzed by a 4 x 3 x 2 x 2 mixed analysis of variance in which the variables were the between-subjects factors of thematic organization, listening-review intervals, and note-taking and the within-subjects variable consisted of scores on the immediate and delayed tests. See Table 1 for a summary of this analysis.

Table 1

Summary of Analysis of Variance for Experiment I

Source	df	MS	F
Thematic Organization (A)	2	2084.68	24.42*
Length of Listening-Review Interval (B)	2	50.41	.59
Note-taking (C)	1	1074.68	12.59*
A x B	4	24.38	.29
A x C	2	118.01	1.38
B x C	2	31.34	.37
A x B x C	4	34.08	.40
Error	72	85.36	

* $p < .001$

Effect of Treatments. The analysis of the number of ideas recalled yielded F (3,92) = 60.55, $p < .001$ for the effect due to thematic relatedness. The mean scores were: $\overline{X}$ = 54.54 for the DUR group; $\overline{X}$ = 38.06 for the DRT group; $\overline{X}$ = 33.31 for the CST group; and $\overline{X}$ = 27.87 for the CRT group. Thus, these findings are in substantial agreement with those obtained in Experiment I. Furthermore, these results indicate that the additional time did allow for the elicitation of more correct ideas but that the advantage still favored the DUR group. Of interest in this regard is the finding that the CST material resulted in increased recall over the CRT material supporting the notion that there is an optimal amount of relatedness among paragraphs beyond which there is likely to be a debilitating effect on recall. A detailed summary of these results is presented in Table 2.

As in Experiment I, the effect due to note-taking yielded F (1,92) = 27.65, $p < .001$. The subjects who were allowed to take notes recorded a mean of 42.36 correct ideas while the group that did not take notes recorded 34.56 correct ideas on the average.

It is interesting to compare the results described in the aforegoing with the results obtained when the sheer number of words recalled is used as the dependent variable. The effect of thematic organization on this measure yielded F (3,216) = 21.77, $p < .001$. The differences related to this analysis are reflected in the means of 503.4 words used by the DUR group; 393.6 words by the CST group; 345.6 words by the CRT group; and 315.6 words by the DRT group. Thus, although the DUR group produced both the greatest number of ideas and words there was little relationship between the two variables in the results of the other groups.

Table 2

Number of Ideas Recalled From Each of the Segments

Of Each Passage According to Thematic Organization[a]

Continuous Related Theme		Continuous Scrambled		Discontinuous Related		Discontinuous Unrelated	
Segment	$\bar{X}$	Segment	$\bar{X}$	Segment	$\bar{X}$	Segment	$\bar{X}$
1	5.12	1	5.85	DDT	9.63	Chou Dynasty	8.02
2	4.73	2	4.43	Chlordane	4.88	Hypnosis	7.55
3	4.12	3	5.90	Dieldrin	4.40	Xenograde	12.08
4	4.18	4	6.57	Endrin	7.75	Prison System	6.80
5	5.15	5	5.88	Parathion	5.73	Minnesota Theater	8.02
6	4.57	6	4.68	Malathion	5.67	DDT	11.23
Total	27.87		33.81		38.06		54.54

[a] The segments in the continuous-related and continuous-scrambled segments are identical in this table. The segments were placed in the 4, 2, 5, 1, 6 and 3 positions during presentation in the latter treatment. The DDT passages in the last two columns were identical.

The analysis of two forms of the immediate true-false test yielded no significant difference due to form of the test so all subsequent analyses were based upon pooling of subjects across this factor. The mixed analysis of variance of the data from the immediate and delayed recall tests involved the four treatments related to thematic organization of the material and the two note-taking treatments as between-subjects variables. The immediate and delayed tests were employed as the within-subjects variable. This analysis yielded F (1,192) = 6.29, $p < .01$ for the effect due to note taking; the no-notes group achieved an average score of 51.5 correct items while the group that took notes achieved a mean score of 53.2 correct items. Of particular interest is the finding that, as in Experiment I, there were no significant differences ($p > .10$) among the groups on the immediate test. Thus, the means were 23.6 for the DRT theme, 22.4 for the DUR theme, 22.5 for the CRT theme, and 22.8 for the CST theme. However, the effect due to the interaction between thematic organization and delay of test yielded F (3,192) = 5.00, $p < .002$. Inasmuch as the effects on the immediate test were not significant this interaction reflects the significance of the differences among thematic organizations of the material on the delayed test. The order of the means for these groups differed from the order of those obtained in the previous analyses, they were: $\bar{X}$ = 85.6 for the DRT group; $\bar{X}$ = 82.2 for the CST group; $\bar{X}$ = 80.0 for the DUR group; and $\bar{X}$ = 79.6 for the CRT group. Calculations of t-tests indicate that of the latter three means are significantly ($p < .01$) different from the mean for the DRT group but are not significantly ($p > .05$) different from each other.

While there were slight differences in results from the two experiments the poorer performance under continuous related thematic material was reliably replicated. The differences in results from the two experiments may be due, in part, to the longer time allowed the subjects in Experiment II for the free-recall test.

Individual differences. The relationships between the individual difference variable (memory span) and performance measures are presented in Table 3. It can be seen in that table that only two of these correlations are significant ($p = .05$): one was the correlation between memory span and number of ideas produced ($r = .38$) for subjects in the DRT, note-taking treatment; the other was the correlation between memory span and the delayed true-false test ($r = .42$) in the CRT-note-taking treatment. These, of course, may have occurred by chance, and any conclusions can only be suggestive. Nevertheless, there is some consistency in these data since both memory-span scores (one based on number of digits recalled and the other based on correct recall of all digits in a triplet in the correct order) yielded similar correlations, all were positive, and all were found in the note-taking groups. By contrast the set of correlations between the immediate and delayed true-false scores and the memory-span tests, for the CRT no-notes group are all negative and although not significantly different from zero are significantly different from the aforementioned correlations. Nevertheless, when tests of parallelism for regression was made on these data, no significant F ratios were found, indicating that there was insufficient evidence for rejecting the hypothesis that the regression lines were parallel in the population.

Table 3

Summary of Correlations Between A Measure of Memory Span and Several Performance Measures Based on Groups (n = 25) Receiving Variations in Thematic Relatedness and Note-taking Treatments

Experimental Treatment	Correlation Between: Immediate True-False Test and MS I[a]	Immediate True-False Test and MS II[b]	Delayed True-False Test and MS I[a]	Delayed True-False Test and MS II[b]	No. of Words Produced and MS I[a]	No. of Words Produced and MS II[b]	No. of Ideas Produced and MS I[a]	No. of Ideas Produced and MS II[b]
Discontinuous-Related Theme								
No Notes	-.01	-.04	-.13	-.23	.16	.14	.04	.00
Notes	.05	.10	-.04	-.07	-.03	-.04	.38*	.35*
Discontinuous-Unrelated Theme								
No Notes	-.02	-.09	.18	.15	.23	.19	.26	.12
Notes	-.10	-.13	.16	.13	.33	.12	.13	.07
Continuous-Related Theme								
No Notes	.08	.06	.04	.04	.03	.03	-.01	-.01
Notes	.01	.21	.26*	.42*	-.29	-.02	-.24	.04
Continuous-Scrambled Related Theme								
No Notes	-.27**	-.29***	-.31**	-.24**	.01	.00	.01	-.12
Notes	-.11	.04	-.15	-.18	-.02	.19	-.21	-.03

* Asterisked figures indicate differences between note-taking and no-notes groups in relationships between the individual difference variable and performance that may warrant further analysis or more explicit investigation to identify trait-treatment interactions. Nevertheless, only two of these are significant (a correlation of .38 is required for p = .05, two-tailed test).

** These are not significant, but are noted since they are opposite in sign from the single-asterisked items and occur for the no-notes group.

[a] Memory Span I. There were 12 CCC's in the task. For this score, a subject received a score of 1 if he had correctly recalled all 3 C's in their proper order. He received a score of 0 if any consonant was missing or if any consonant was misplaced. (Total possible score = 12).

[b] Memory Span II. The total possible points for this score were 72 (6 for each CCC). The subject received 1 point for each consonant recalled and 1 point for the correct positioning of each consonant in the CCC.

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Discussion

The results of the present study indicate that note-taking and thematic relatedness were related to the ability of the subjects to recall the material to which they listened. These effects were especially to be noted on the free-recall task immediately after listening and on the delayed true-false test. This finding replicates one obtained by Crawford (1925) who also concluded "A careful analysis of all the facts seems to justify the conclusion that the immediate value of notes is less than the delayed-review value. This immediate value is of sufficient importance, however, to justify the practice of taking notes, even if there is no opportunity to use them later." (p. 384). There were no significant effects on either recognition and recall immediately after listening or on recognition a week later, due to variations in the listening-review intervals.

The results concerning note-taking clearly indicate the importance of this learning device as an aid to recalling material to which one listens. We share Crawford's (1925a) conclusion that "... taking notes on a point does not guarantee its being recalled at the time of the quiz but failing to take note of it very greatly decreases its chances of being recalled" (p. 289). Nevertheless, the reason for the beneficial effects of note-taking is not answered by any of the studies, either the present one or any of those listed in the references. If note-taking is beneficial because it serves as an external storage mechanism then it should interact with a review period, which it does not either in the present study or in an earlier one (Di Vesta & Gray, 1971, in press). If it serves as a coding mechanism, then it can be

assumed that note-taking ought to be more beneficial with unrelated material than with related material which already has a built in organization. Our investigation of two variations of review periods points toward discarding the notion that note-taking serves only as an external storage mechanism. Nevertheless, other investigations in which internal relatedness of material is varied on other bases than those employed in the present study must be conducted before the view that note-taking serves as a coding mechanism is abandoned.

The fact that thematic relatedness, as a variable, was related to recall was not surprising. The surprising result was, of course, that the degree of retention was greatest, in both experiments, for the material that was not thematically related. This conclusion holds for the simple comparison of the retention of passages that were placed in a logical connected order with the retention of the same passages when the order of its paragraphs were scrambled. The result was even stronger where the paragraphs comprising the listening passage cover clearly different topics.

One might argue that the thematic-connectedness of the passages in the latter comparison is confounded with difficulty level. The final answer to this argument can only be determined by conducting an experiment in which difficulty is controlled. At present, there is no reliable procedure, of which the present authors are aware, for equating difficulty of connected discourse passages. However, on casual inspection it can be said that the passages in all conditions appeared to be of equal difficulty and in the discontinuous-unrelated thematic treatment one of the six paragraphs was identical to that presented in the discontinuous-related thematic condition. Recall in the latter

condition was far superior to recall in the former condition. Certainly, the argument related to relative difficulty of passages can not hold for the treatment in which the paragraphs in the continuous related thematic material were scrambled and where recall of all but one of the passages was better in the continuous-related-scrambled organization than it was in the continuous-related organization.

Lacking contradictory evidence it shall be assumed for purposes of discussion that these results reflect the effect of variations in thematic relatedness. If this is the case, then the findings suggest a phenomenon somewhat akin to release from proactive inhibition (Wickens, 1970). Thus, where the material contains a large number of ideas which are all highly related (as they were in the passages describing the fire ant, its activities and control) then initial ideas can have a detrimental effect on the recall of subsequent ideas. On the other hand, where a passage is discontinuous in the sense that its constituent paragraphs cover different topics, then any proactive inhibition developed in a given passage is eliminated by the abrupt change in ideas. All this is speculative, of course; but it appears not only to offer a possible explanation of the results but also to suggest a means of testing the notion of "release from PI" with connected discourse.

These conclusions gain strong support from the findings reported by Anderson and Carter (1971) in a study conducted quite independently of the present one. They found that "The groups which learned verbatim, paraphrase, or verbatim-arranged sentences forgot significantly more than the group which learned new sentences" (quote from the abstract of the Anderson and Carter report). Their discussion of these results

was as follows: "Such interference could not have occurred had the subjects rotely learned perceptual or acoustic features, since a paraphrase and its base do not share these surface features. The interference must have been at a semantic level. There is now a convincing case that interference theory accounts for the forgetting of meaningfully-learned connected discourse" (p. 6).

It is not clear why variations in listening-recall intervals did not produce an effect. In principle, variations in the length of the listening period are comparable to variations in massed and distributed practice. Similarly, frequency of review intervals is comparable to increases in opportunity for consolidation. In either case, it would be expected that at least one of the present treatments would have been clearly superior to another. Obviously, none was.

There are two possible reasons for the failure of the manipulation of listening-recall intervals to affect recall. First, the opportunity to review notes or to contemplate the material may have eliminated any detrimental effects that accrue from massed practice for passages that were no longer than 30-min. In this instance, another condition might have been provided in which the subjects were prevented from reviewing their notes or from considering the material during the consolidation period by performing another unrelated task. Second, the taking of notes may be itself a sufficient condition for consolidation of material learned. But in this instance, the test of the hypothesis would have required a condition in which the subject was not permitted to take notes, a condition included in the present experiment. While the former treatment suggested was employed in the previous study (Di Vesta and

Gray, 1971, in press) they were not crossed with the length of the listening-review period, as they must be for adequate test of these additional hypotheses.

In his early study conducted nearly half a century ago, Crawford (1925) pointed out the importance of investigating the dynamics of note-taking as follows: "... if note-taking is beneficial, as we have found it to be, there is great need of an analysis of note-taking practice and procedure in greater detail to teach students how to get the best possible results from their efforts" (p. 291). For a number of reasons the topic was not taken seriously until investigators such as M. J. A. Howe (1970) and Berliner (1970) only recently took the initiative. It appears that further analyses of the process as an instrumental activity in learning should be a productive source of hypotheses for investigations in the applied psychology of learning and instruction.

We have felt it important in this discussion to depart from the typical interpretation of data in order to suggest additional avenues for research on the topic of note-taking and listening. As M. J. A. Howe (1970) suggests "... more detailed investigation making use of notes made by students as a way of attempting to examine the relationships between learning and individual coding processes would be justified. For instance, it would be interesting to explore individual differences in note-taking and to examine the effects of different note-taking strategies upon subsequent recall of meaningful materials" (p. 63). Of particular importance, in this regard, are questions related to the entire issue of coding. For example, more needs to be known about the specific points made in notes and their relationship to what is recalled

and what is not recalled. Furthermore, it is probably true that some students record notes in a verbatim way while others record notes in elaborate organizational schemes with a great deal of translation. Still others record notes verbatim but then reorganize, translate, and elaborate on them after the lecture. These are variations in encoding mechanisms. Investigations on such variables should provide considerable information on the cognitive processes.

References

Anderson, R. C., & Carter, J. Retroactive inhibition of meaningfully learned sentences. Urbana, Illinois: University of Illinois, 1971. (Mimeo)

Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt, Rinehart and Winston, 1968.

Berliner, D. C. Effects of test-like events and note-taking on learning from lecture instruction. Amherst, Mass.: Technical Report, Center for Educational Research, March, 1970.

Carson, R. L. Silent spring. Boston: Houghton-Mifflin, 1962.

Crawford, C. C. The correlation between college lecture notes and quiz papers. Journal of Educational Research, 1925, 12, 282-291. (a)

Crawford, C. C. Some experimental studies of the results of college note-taking. Journal of Educational Research, 1925, 12, 379-386. (b)

Di Vesta, F. J., & Gray, G. S. Listening and note-taking. Journal of Educational Psychology, 1971, in press.

Eisner, S., & Rohde, K. Note-taking during or after the lecture. Journal of Educational Psychology, 1959, 50, 301-304.

Hebb, D. O. A textbook of psychology. Philadelphia: W. B. Saunders, 1966.

Howe, M. A. Introduction to human memory: A psychological approach. New York: Harper and Row, 1970.

Howe, M. J. A. Using students' notes to examine the role of the individual learner in acquiring meaningful subject matter. Journal of Educational Research, 1970, 64, 61-63.

Loveland, F. Classification in the prison system. In N. Johnston, L. Savitz, and M. E. Wolfgang (Eds.) The Sociology of Punishment and Correction. New York: Wiley, 1962.

Merrill, M. D. Transfer effects wtihin a hierarchical learning task as a function of review and correction on successive parts. [Office of Naval Research Technical Report No. 5, Training Research Laboratory, University of Illinois, Contract Nonr 3985 (04), September, 1964] Ann Arbor, Mich.: University Microfilms, 1965. No. 23-029.

Peterson, L. R., & Peterson, M. J. Short-term retention of individual verbal items. Journal of Experimental Psychology, 1959, 58, 193-198.

Watkins, J. G. Hypnosis. In N. L. Faberow (Ed.) Taboo topics. New York: Atherton, 1966. Pp. 96-106.

Wickens, D. D. Encoding categories of words: An empirical approach to meaning. Psychological Review, 1970, 77, 1-15.

Summary

The Effects of Congruence Between Passage Organization and an Imposed Strategy on Clustering and Recall of Textual Materials

Francis J. Di Vesta, Charles B. Schultz, and Timothy R. Dangel

Technical Problem

Simple statements typically are comprised of a concept name and a concept attribute, e.g., "Atweena (concept name) is a mountainous country (coucept attribute)." Statements such as this can be grouped into paragraphs in which the common organizational element is a concept name or a concept attribute, or in which no systematic organizational pattern is used. As they study written passages, learners may subjectively cluster statements in a similar way. The primary purpose of the present experiment was to compare the imposition of a subordinate strategy which was incongruent with the passage organization to a condition in which both passage organization and clustering strategy are congruent.

General Methodology

The subjects had four trials to learn a written passage about six imaginary nations. For the first three trials, subjects were given a three-minute study period and a six-minute writing period (i.e., the free-recall test). In one treatment, passages were organized by concept name, concept attribute, or by a random selection of statements. One third of the subjects in each passage organization group were instructed

to use a name clustering strategy, one-third an attribute strategy, and the remainder were given no particular organizational instructions. On each trial, measures of statements correctly recalled, name clustering ratios, and attribute clustering ratios were obtained. In addition, a secondary organization score was obtained reflecting the consistency of internal organization of clusters from one cluster to the next.

Technical Results

The subjects who studied passages organized by either name or attribute recalled more than subjects who studied passage without an organizational pattern. Preference was also found for the name clustering strategy in contrast to the attribute strategy. The adoption of the less-preferred attribute strategy was gradual when the subject studied the attribute passage and was free to choose his own clustering strategy compared to a condition which was similar in all respects except that the attribute strategy was imposed. One of the most interesting findings was that incongruence between passage organization and clustering strategy resulted in more recall than congruence.

Educational Implications

These findings underline the importance of making the organizational pattern of learning materials apparent to the learner. The learner must concentrate on defining an organizational pattern for loose and unstructured textual materials if recall of the material is not to be impaired. Moreover, the more organizational cues the instructor provides for the learners, the greater the recall. Since often textual material contains both names and attributes, the characteristics of both dimensions should be brought to the learner's attention.

Implications for Further Research

The present study can be extended in at least two directions. One tact is to examine the effect of the matrix clustering strategy, implied by the use of a system of secondary organization in the present study, on recall and on other processes such as inference-making. In addition, the learner's clustering strategies and their relation to recall could be examined when the instructional materials are presented orally (i.e., approximating a lecture form) rather than in textual form.

The Effects of Congruence Between Passage Organization and an Imposed Strategy on Clustering and Recall of Textual Materials

Francis J. Di Vesta, Charles B. Schultz, and Timothy R. Dangel

Textual materials can be organized into paragraphs in which the central organizing elements is a concept name or a concept attribute, or the statements can be placed in paragraphs which have little or no apparent organizational structure. For example, the sentence, "Atweena (concept name) is an island nation (concept attribute)," can be placed in a paragraph with other statements about Atweena (e.g., "In Atweena, the society is largely industrial"), in a paragraph with statements about the geography of different nations (e.g., "A mountainous terrain characterizes much of Egrama"), or in a paragraph with randomly selected statements. Just as passages may be organized according to concept name or attribute, learners themselves may subjectively cluster statements in a passage using similar rules in an effort to facilitate learning and improve retention.

In earlier studies, Frase (1969) and Schultz & Di Vesta (1972) have demonstrated that passages organized by name or attribute result in greater recall than passages without an organizational pattern, that clustering in recall is influenced by passage organization, and that the concept name clustering strategy is preferred over the concept attribute strategy. Since clerical employees and high school students, respectively, were used as subjects in these experiments, the present

investigation provides a basis for generalizing these findings to other populations, college students, who presumably are more adept verbally and who have had more experience studying textual materials with different organizational patterns, were employed.

A particularly interesting finding from the Schultz & Di Vesta (1972) study was that name and attribute clustering strategies were adopted at different rates. Thus, concept name clustering strategy was found to be used in the first encounter with the passage organized by name, but the concept attribute strategy was adopted only after several exposures to the passage organized by attribute. The data imply that when the dominant clustering strategy is congruent with the passage organization, it is immediately adopted; when the subordinate strategy is congruent with the passage, it is gradually adopted perhaps because of interference from the dominant strategy. This implication, stated as an hypothesis, was tested directly in the experimental design of the present study. Accordingly, subjects were required to adopt either the dominant strategy, the subordinate strategy or, in a third treatment, were free to adopt any strategy they wished to use.

Finally, Schultz & Di Vesta (1972) found that recall was impaired and errors more frequent during the first trial of learning a passage organized by attribute when reliance on the incongruent name strategy was presumably greatest. This finding implies that a clustering strategy which is incongruent with the organizational structure of the passage may inhibit learning and retention of textual materials. Accordingly, it was hypothesized, for the present study, that the imposition of a clustering strategy which was congruent with the passage organization would result in greater recall and fewer errors than when

the imposed passage and clustering strategy were incongruent with the passage organization.

Method

Design

College students were given three trials to learn a passage which described six imaginary nations. Each trial was comprised of a brief study period followed by a free-recall test. After the third trial, subjects completed a task which was intended to prevent rehearsal of the passage before the administration of a fourth free-recall test. The number of correct responses and clustering ratios were obtained on each free-recall test.

Three levels of passage organization (concept name, concept attribute, and random sentence sequence) were orthogonally crossed with three sets of instructions for grouping the statements in the passage (name grouping, attribute grouping, and no specific grouping instructions). These manipulations imply a 3 x 3 x 4 mixed analysis of variance design, with repeated measures on the last factor, the free-recall test.

Subjects

The 99 subjects were undergraduate students enrolled in an introductory educational psychology course at The Pennsylvania State University. Students were awarded standard score points toward their grade for participation in the experiment. The experimental sessions were conducted with groups of nine subjects, each of whom was randomly assigned to a different experimental condition.

Experimental Materials

The study passage was similar to that used in the earlier experiment (Schultz & Di Vesta, 1972). It consisted of 36 statements describing six imaginary nations called Atweena, Brontus, Egrama, Nurovia, Bismania, and Galbion. The geography, government, mood, technology, population growth, and birth rate were described for each nation. It was possible, therefore, to use the same 36 statements to construct three passages with different organizational patterns. In one the statements were arranged into six paragraphs each with six sentences about the same nation. In a second organizational pattern, each paragraph was comprised of statements about the same attribute. A third passage contained six paragraphs with statements randomly selected from the same pool of statements as that used in the preceding conditions.

Procedure

The experiment was conducted in a language laboratory. Each of the nine subjects worked in an isolated booth and wore earphones. Only the timing signals and instructions for all phases of the experiment were tape-recorded and received by the subject as he read a printed version of the instructions included in an answer booklet. The language laboratory facility permitted the simultaneous presentation of instructions for nine different experimental conditions.

The subject's task was to learn a passage containing descriptions of six imaginary nations. Each study-recall trial consisted of a 3-min. study period, during which time subjects were instructed to read and study the complete passage without the assistance of notes, and a 6-min. writing period, during which time they were instructed to write down all the statements they could remember (i.e., the free-recall test).

Organization treatments. One experimental variation consisted of manipulating the organization of the passage as described in the Materials section. Briefly, some subjects read a passage with paragraphs organized by name, (Concept Name Passage), while others studied a passage with paragraphs organized by attribute (Concept Attribute Passage) or a passage comprised of randomly ordered statements (Random Order Passage).

Instructional sets. One-third of the subjects assigned to each of the organization treatments were instructed to learn the passage by grouping the material according to the concept name (Concept Name Instructions). Another one-third of the subjects assigned to each of the organization treatments were given instructions to learn the passage by grouping the material by concept attribute (Concept Attribute Instructions).

The remaining third of the subjects assigned to each of the organization treatments were instructed to either rehearse the statements, to group them, to use a mnemonic "gimmick," or to use whatever plan or strategy they felt would help them remember the passage (No Organizational Instructions).

Intervening task. Following the third trial, subjects were given a ten-minute task designed to prevent rehearsal of the passage and to provide a measure of memory decay. The intervening task was based on procedures used in the Peterson & Peterson (1959) study of short-term memory. The subjects first heard a three-consonant syllable which was immediately followed by a three-digit number. The number served as a reference point from which subjects counted backwards aloud by threes (or fours) in time with a signal presented at half-second intervals

before attempting to recall the syllable. There were 12 such trials administered. For the first four trials, the time spent counting backwards was three seconds; for the second four trials, the time was six seconds; and for the last four trials, subjects counted for nine seconds. Immediately following the short-term memory task, a fourth free-recall test was administered without a study period.

Association test. An association test followed the fourth writing period. For this task, 12 cue statements from the passage were read to the subjects. They were instructed to respond to each statement by writing the first statement from the paragraph that came to mind. For example, when the cue, "Egrama is characterized by a mountainous terrain," was read, the subject could respond with another statement about Egrama (suggesting name organization) or with a statement about the geography of a different country (suggesting attribute organization). Since each cue statement contained a name and an attribute, subject's responses could be analyzed to determine the ratio of name or attribute associations he made. A score based on the association test was computed by subtracting attribute ratio from name ratio and adding 1.00. This procedure yielded a range of zero to two. Low scores reflect attribute clustering while high scores reflect name clustering.

A post-experimental questionnaire was administered at the conclusion of the experiment. The subject was asked to describe his strategy for learning the statements in the passage. The subject rated the instructions for grouping the statements on a scale consisting of the following points: very helpful, somewhat helpful, neither helpful nor interfering, somewhat interfering, or very interfering. The subject also listed his credits in history and the social sciences.

Scoring

The free-recall protocols were scored according to procedures described more fully by Schultz & Di Vesta (1972). They consisted of obtaining measures of correct statements recalled, name clustering ratios (which reflect the amount of organization in free-recall by concept name) and attribute clustering ratios (which reflect the amount of organization in free-recall by concept attribute).

For scoring purposes a "cluster" was defined as two or more consecutive statements about the same name or about the same attribute. Another score was also obtained, to reflect the degree of consistency of organization across clusters for a given trial. It showed whether the sequence of statements within the dominant bases for organization (i.e., name or attribute) was in the same inter-cluster order. Thus, for example, if the dominant basis for organization was name, the statements would be organized within each name by attributes. With perfect consistency (represented by a score of 1.0) the attributes would be recalled in exactly the same order from one cluster to the next. With complete inconsistency represented by a score of zero, the order of attributes recalled in one cluster would bear no relationship to the order of attributes recalled in the subsequent clusters.

Results*

Analyses were conducted of clustering scores and statements correctly recalled, on each of the four free-recall trials. Additional analyses were made of the association scores and the sequence within clusters (SWC) scores for the fourth trial. Newman-Keuls procedures were used for all multiple comparisons ($p < .05$). Because of heterogeneity of variance in

*All analyses of variance referred to in this section are summarized in Table 2.

the analyses of repeated measures, corrections were made for analyses of independent (nested) factors with heterogeneous variances and for analyses based on repeated measures.

Induction of Treatments

The association test was used to determine the extent to which the experimental conditions were induced. High scores (i.e., up to 2.0) reflect name organization and low scores (i.e., to 0.0) reflect attribute organization. An analysis of variance of these data yielded F (2,90) = 9.35, $p < .01$ for the effect due to passage organization in which the following order of means was obtained: $\bar{X} = 1.55$ for the Concept Name Passage (CNP) organization, $\bar{X} = 1.26$ for the Random Order Passage (ROP) organization, and $\bar{X} = .87$ for the Concept Attribute Passage (CAP) organization. The ROP and CNP organizations differed from the CAP organization ($p < .05$), but not from each other. The analysis of variance of free association scores yielded F (2,90) = 3.53, $p < .05$ for the effect due to instructions. Mean scores for the Concept Name Instructions (CNI), No Organization Instructions (NOI), and Concept Attribute Instructions (CAI) groups were $\bar{X} = 1.47$, $\bar{X} = 1.08$, and $\bar{X} = 1.14$, respectively. The scores for the CNI group were greater than those of the CAI and NOI groups ($p < .05$) which did not differ from each other. Thus, in both the passage organization and instructional set treatments, the scores of the CN and CA groups differed from each other on the association test. These results implied that the type of organization (name or attribute) employed by the subject was influenced or induced by cues from both the passage and the instructions.

Clustering

Separate analyses of variance were made on the amount of name clustering and attribute clustering during recall. An additional analysis was made of scores which reflect the consistency of the sequence of the order of statements within clusters (SWC). A summary of the means based on the clustering scores is presented in Table 1.

Name clustering. The analysis of variance of name clustering ratios yielded F (2,90) = 6.66, $p < .01$ for the effect due to passage organization. The mean name clustering scores for the three passage organizations were $\overline{X}$ = 68.70 for the CNP organization, $\overline{X}$ = 48.75 for the CAP organization, and $\overline{X}$ = 45.63 for the ROP organization. According to the Newman-Keuls tests, the name clustering ratio for the CNP organization was higher than those for the CAP and ROP organizations which did not differ from each other. The analysis of variance of name clustering scores yielded F (2,90) = 35.20, $p < .01$ for the effect due to instructions. The mean scores for CNI, CAI, and the NOI conditions were $\overline{X}$ = 85.23, $\overline{X}$ = 49.54, and $\overline{X}$ = 28.30 respectively. The name clustering ratios for each group were significantly different from each of the other groups ($p < .05$).

Attribute clustering. The analysis of the attribute clustering ratio yielded F (2,90) = 5.01, $p < .01$ for the effect due to passage organization in which the ratios of the CAP organization ($\overline{X}$ = 49.92) and the ROP organization ($\overline{X}$ = 31.80) were higher than those of the CNP organization ($\overline{X}$ = 22.56). The CAP and ROP organizations did not differ from each other. A similar analysis of the attribute clustering ratio for the effect due to instructions yielded F (2,90) = 39.19, $p < .01$ in which each instructional group is different from the others. The means

Table 1

Summary of Mean Scores on Each Dependent Variable

For Each of the Experimental Conditions

Instructions	Organization of Passage: Random	Attribute	Name	Total
Correct Statements				
None	11.41	12.07	11.57	11.68
Attribute	9.82	12.41	17.48	13.23
Name	9.80	14.91	13.25	12.65
Total	10.34	13.12	14.10	
Name Clustering Ratios				
None	41.91	42.18	64.52	49.54
Attribute	29.52	13.45	41.93	28.30
Name	65.45	90.61	99.63	85.23
Total	45.63	48.75	68.70	
Attribute Clustering Ratios				
None	25.95	43.68	15.68	28.44
Attribute	56.02	81.20	50.98	62.73
Name	13.41	3.89	.98	6.09
Total	31.80	42.92	22.54	
Inter-Cluster Consistency (Fourth Trial Only)				
None	31.27	59.09	48.82	46.39
Attribute	50.36	67.00	91.36	69.58
Name	47.91	81.45	89.23	72.70
Total	43.18	69.18	76.30	
Ratings of Instructions				
None	2.91	2.55	2.73	2.77
Attribute	2.64	2.55	1.82	2.33
Name	2.36	2.00	2.45	2.27
Total	2.63	2.36	2.33	

Table 2

Summary of Analyses of Variance for Each of the Dependent Variables Employed

Source	df	Correct Statements MS	Correct Statements F	Name Clustering MS	Name Clustering F	Attribute Clustering MS	Attribute Clustering F	Sequence Within Clustering (4th Trial) MS	Sequence Within Clustering (4th Trial) F
Between Subjects									
Organization	2	502.30	5.94***	20674.80	6.66***	13743.60	5.01***	10030.50	14.79***
Instructions	2	81.23	.96	109261.00	35.20***	107452.00	39.19***	6814.43	10.05***
Org. x Instr.	4	235.07	2.78**	4756.35	1.53	4240.96	1.55	1019.17	1.50
Error	90	84.50		3103.64		2742.09		678.06	
Within Subjects									
Trials	3	1991.85	204.51***	567.00	1.34	1458.96	4.77***		
Org. x Trials	6	24.57	2.53**	154.84	.37	365.58	1.19		
Instr. x Trials	6	17.52	1.80*	790.27	1.87*	471.62	1.54		
Org. x Instr. x Trials	12	11.25	1.16	467.77	1.10	635.02	2.08***		
Error	270	9.74		423.59		306.06			

*$p < .10$

**$p < .05$

***$p < .01$

of these groups were: $\overline{X}$ = 62.74 for CAI, $\overline{X}$ = 28.44 for NOI, and $\overline{X}$ = 6.10 for CNI. The analysis of the effect due to trials yielded F (3,270) = 4.77, $p < .01$. Mean scores on Trial 1 ($\overline{X}$ = 27.27) differed from Trial 3 ($\overline{X}$ = 33.99) and Trial 4 ($\overline{X}$ = 36.31) but not from Trial 2 ($\overline{X}$ = 32.11).

The analysis of attribute clustering ratios yielded a three-way interaction (F [12,270] = 2.08, $p < .05$) for Instructions, Organization and Trials. None of the two-way interactions were found to be significant ($p > .10$). In order to examine the triple interaction in more detail, an analysis of simple effects for the Trials x Instruction interaction was conducted at each level of passage organization. At the CNP and ROP organization levels, there were no Trial x Instructions interactions. However, a Trial x Instructions interaction was obtained at the CAP organization level (F [6,90] = 3.67, $p < .05$). As can be seen in Figure 1, subjects in the CAI and CNI conditions do not change in their use of the attribute clustering strategy across trials. However, according to the Newman-Keuls test, attribute clustering scores in Trials 1 and 2 differed from those on Trials 3 and 4 for subjects in the NOI group. On Trial 1 attribute clustering scores for the CA Instructions group were higher than those of the NOI and CNI groups which did not differ from each other. By Trial 4, attribute ratios of both the CAI and NOI groups were higher than those of the CNI group, but not different from each other. This finding clearly supports the hypothesis that the adoption of a subordinate clustering strategy is gradual, occurring only after several encounters with a passage characterized by a given organization (i.e., name or attribute).

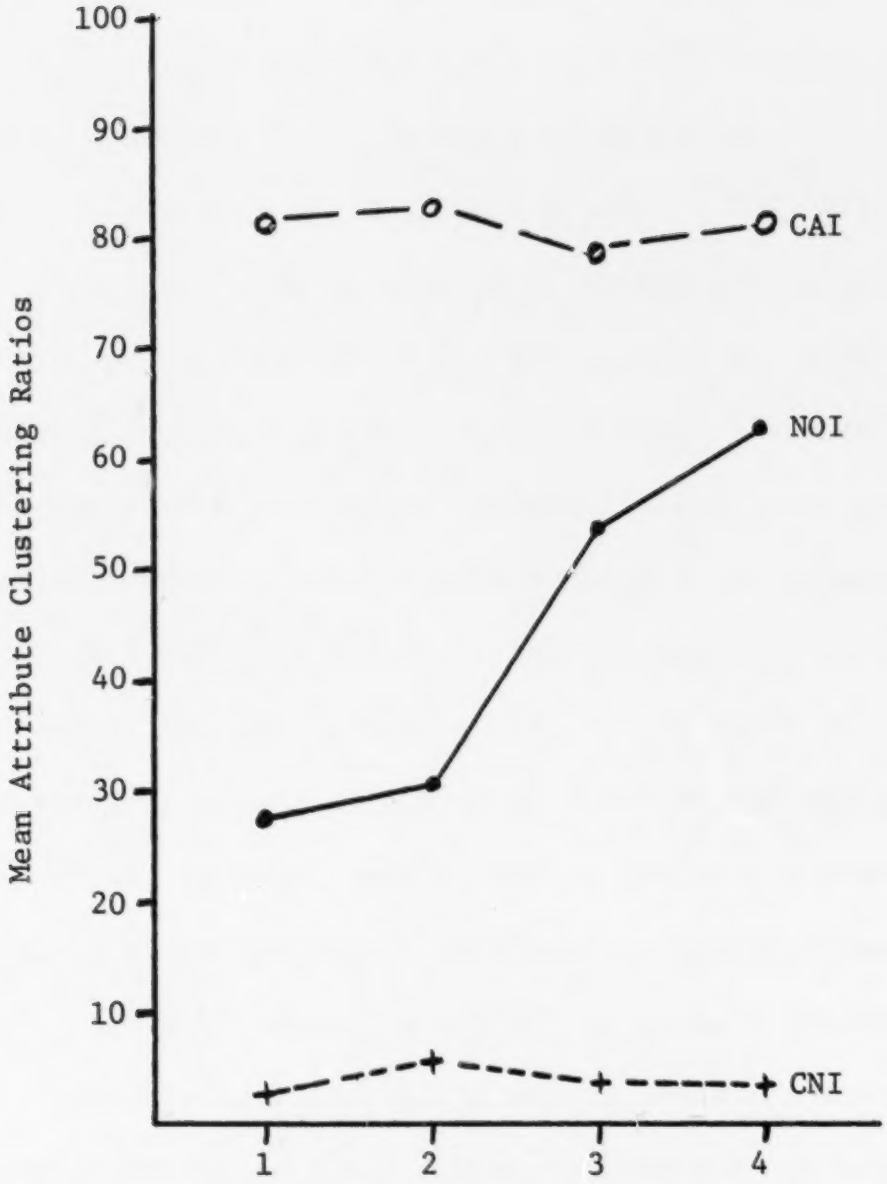

Figure 1. Attribute clustering scores of the concept attribute organization group for three instruction groups across trials.

It was also hypothesized that unlike the gradual adoption of the concept attribute clustering strategy when no organization instructions were provided, the concept name clustering strategy would be adopted in the first trial. In order to test the interaction implied by this hypothesis, a clustering score was required which would reflect both concept name and attribute factors. Accordingly, a combined clustering score was obtained as follows: concept name ratio - concept attribute ratio + 100. High scores (up to 200) imply name organization and low scores (to 0.0) imply attribute clustering.

A contrast to test the interaction between name and attribute passage organization in Trial 1 and Trial 4 for subjects in the NO Instruction group yielded t (270) = 2.67, $p < .01$. The means for the above analysis are graphically displayed in Figure 2 where it may be seen that the clustering data clearly imply that the strategy of organizing by name was immediately adopted and maintained, while the adoption of the clustering strategy of organizing by attribute was very gradual over trials. By Trial 4, the CNP organization differed significantly from the CAP organization (t [90] = 2.05, $p < .05$). This finding replicates an earlier one obtained by Schultz & Di Vesta (1972) on the selection of dominant and subordinate strategies.

Internal consistency of clusters. The analysis made of the amount of sequencing within clusters (SWC) were obtained from Trial 4, the means for which are summarized on Table 1. The analysis of SWC's yielded F (2,90) = 14.79, $p < .001$ for the effect due to organization. The direction of the mean SWC scores were as follows: $\overline{X}$ = 76.30 for CN organization, $\overline{X}$ = 69.18 for CAP organization, and $\overline{X}$ = 43.18 for ROP organization. The CAP and CNP organizations differed from the ROP

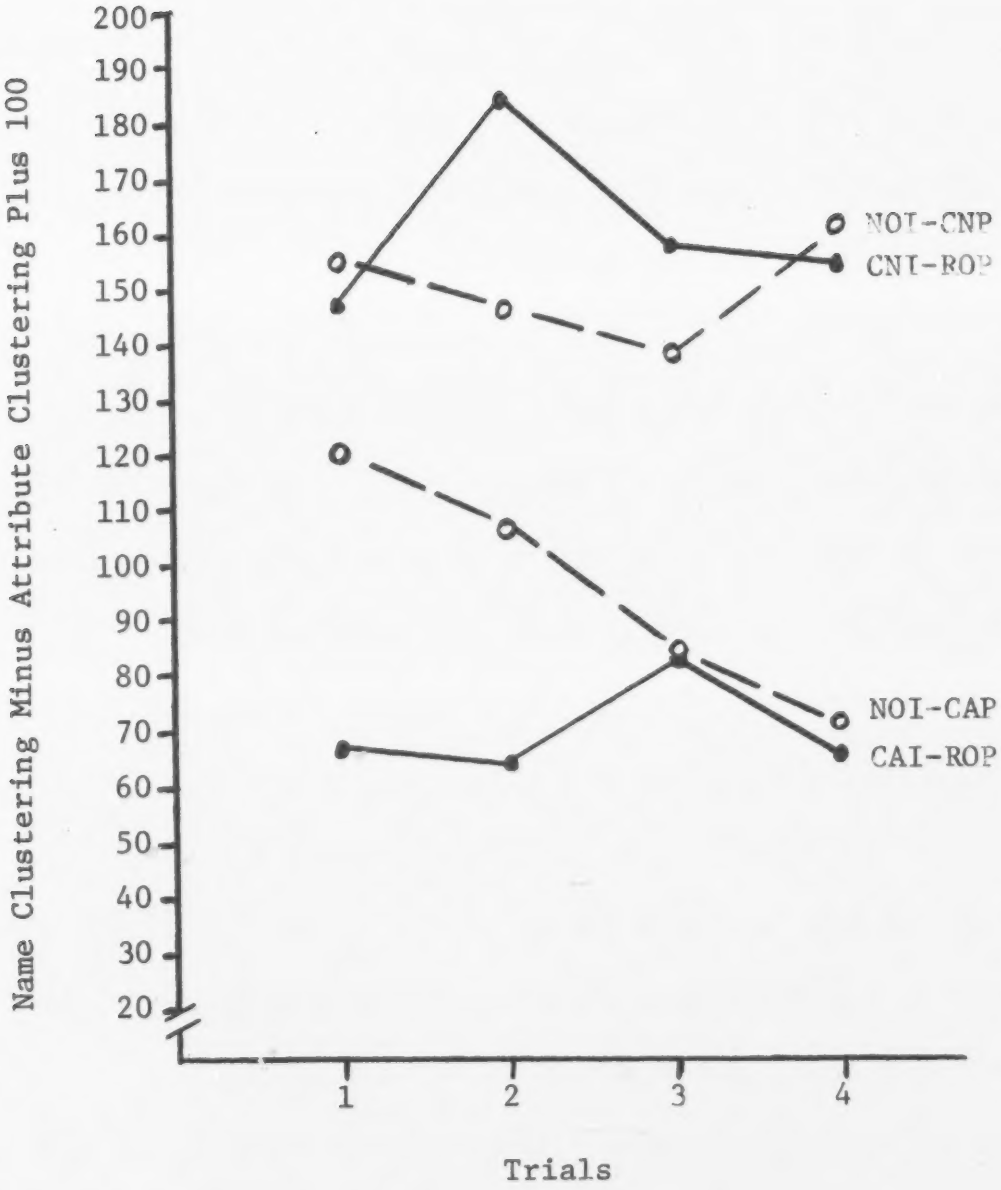

Figure 2. Name clustering score minus attribute clustering score plus 100 for four instruction and organization groups across trials.

organization, but not from each other. A similar analysis of the effect of instructions yielded F (2,90) = 10.05, $p < .001$. Scores for the CAI ($\bar{X}$ = 72.70) and the CNI ($\bar{X}$ = 69.58) conditions were higher than for the NOI condition ($\bar{X}$ = 46.39) but not from each other.

In order to determine whether one strategy was more dominant than the other in the present study, a t test of correlated means of the name and attribute clustering ratios was made (McNemar, 1969, p. 113-114). This analysis yielded t (98) = 3.11, $p < .01$, implying preference for name over attribute strategies, thereby providing direct support for earlier findings by Frase (1969) and Schultz & Di Vesta (1972).

Recall of Correct Statements

The analysis of variance of statements correctly recalled yielded $F < 1.0$ for the effect due to instructions. A similar analysis of the effect due to passage organization yielded F (2,90) = 5.94, $p < .01$ in which both CNP ($\bar{X}$ = 14.10) and CAP ($\bar{X}$ = 13.13) recalled more than the ROP group ($\bar{X}$ = 10.34) but did not differ from each other. A Passage Organization x Instructions interaction was also obtained (F [4,90] = 2.78, $p < .05$) as represented in Figure 3. A comparison of simple effects with the Newman-Keuls test yielded the following: (a) recall by the NOI group did not differ across different passage organization treatments; (b) recall by the CNI group was greater in both the CNP and CAP treatments than in the ROP treatment; (c) recall by the CAI group was greater in the CNP treatment than in the CAP or ROP treatments; and (d) recall by the CAI group with the CNP treatment was greater than that of the CNI and NOI groups who also studied the CNP passage. Thus, the interaction effect appears to be attributable largely to the superior

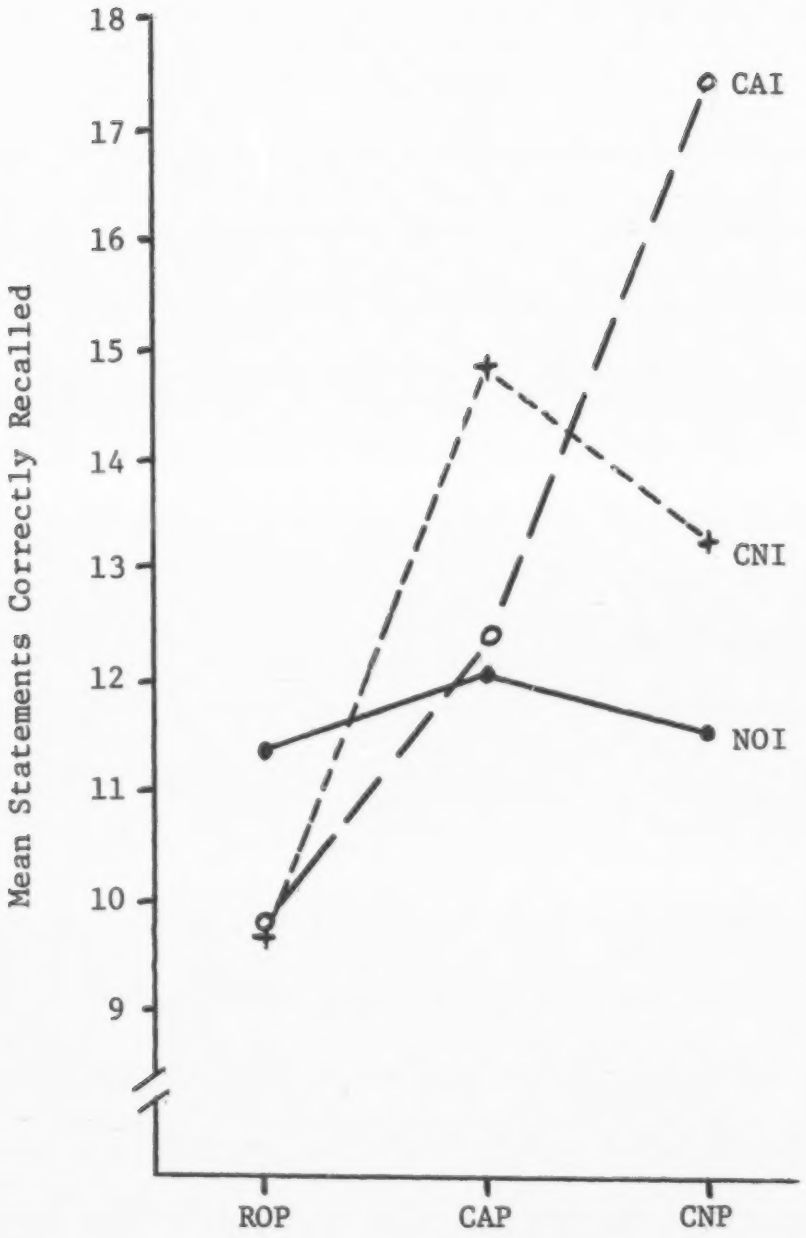

Figure 3. Mean statements correctly recalled by subjects in the Random, Concept Attribute, and Concept Name organization groups with three different levels of organizational instructions.

recall of subjects with concept name instructions who studied the concept attribute passage.

The analysis of variance of correct statements also yielded a significant effect, F (3,270) = 204.51, $p < .01$, due to trials, as well as a significant Trials x Organization interaction, F (6,270) = 2.52, $p < .05$). The most important features of this interaction, displayed in Figure 4, is the tendency for recall in the ROP group to become increasingly depressed relative to that of the CNP and CAP groups, with additional trials, until by Trial 4 it was significantly lower than the two groups receiving organized passages.

Effect of Congruency Between Passage Organization and Instructional Sets

A primary interest in the present study was the comparison of recall by subjects whose passage organization was either congruent or incongruent with the clustering instructions they received. It was hypothesized that congruence between passage and instructions would result in greater recall than incongruence. The means for statements correctly recalled under these conditions are summarized in Table 1. There it may be seen that the results are opposite to the hypothesized direction; thus, scores for groups in which both manipulations were congruent (i.e., attribute passage-attribute instructions and name passage-name instructions) were lower than scores for groups in which both manipulations were incongruent (i.e., attribute passage-name instructions and name passage-attribute instructions). A test of the interaction implied by the direction of these means yielded t (90) = 2.43, $p < .02$ indicating significantly greater recall when the passage organization and clustering strategies were incongruent than when they were congruent.

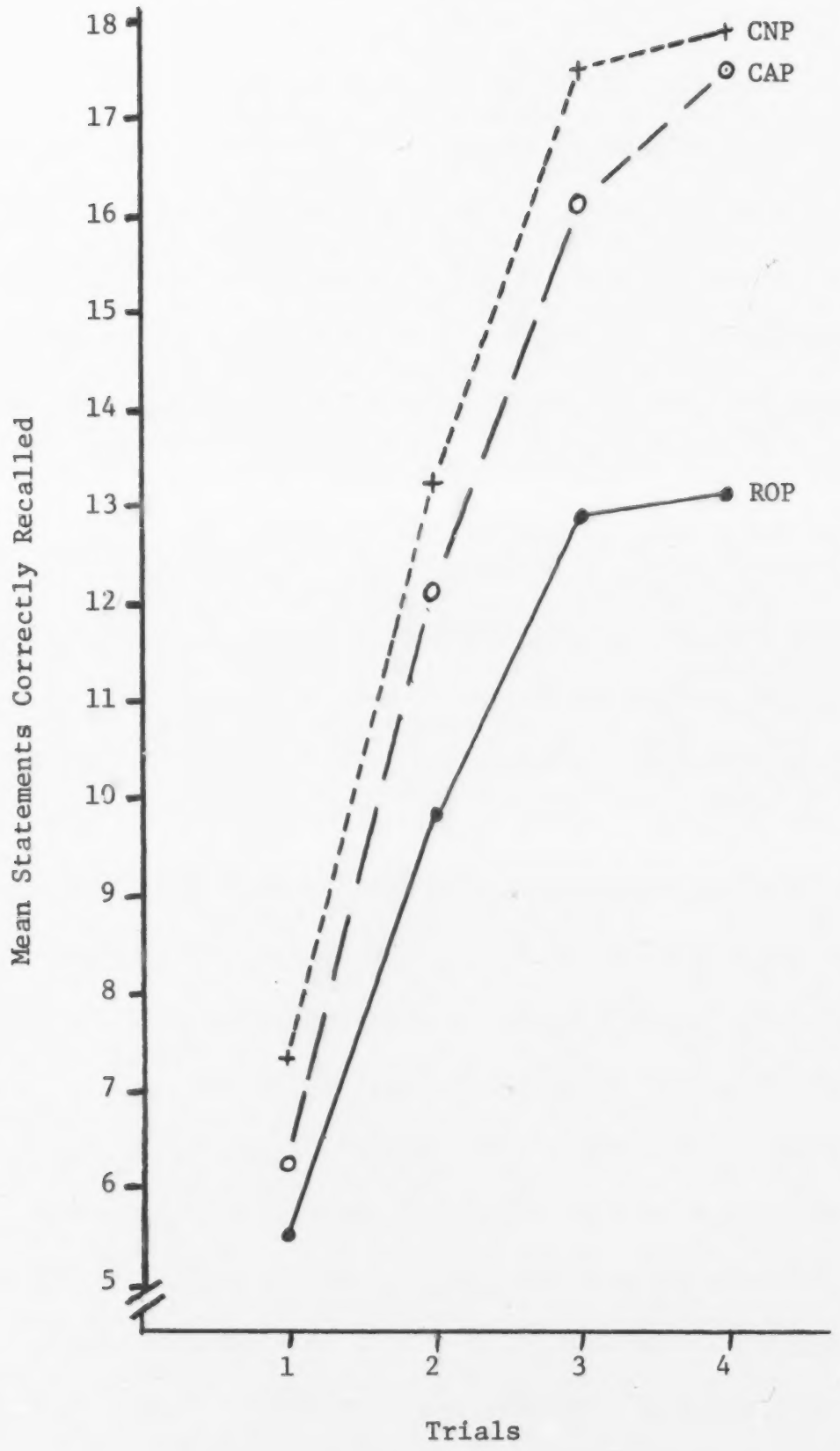

Figure 4. Mean statements correctly recalled for three different passage organizations across trials.

The results described in the aforegoing paragraph, and based upon recall scores, were supported by subjects' ratings of the helpfulness of the instructional treatments. These subjective reports provide an independent rating inasmuch as the subjects received no evaluational feedback, neither norm-referenced or criterion-referenced, about their performance. The analysis of particular interest is that concerned with the interaction between Name and Attribute Instructional Sets and Name and Attribute Passage Organization. The interaction contrast involving these four cells yielded t (90) = 2.18, $p < .05 > .02$. As may be seen in Table 1, the magnitude of these ratings varied directly with the magnitude of the recall scores. Thus, when passage organization and instructional set were incongruent the instructions were rated as more helpful (represented by lower scores) than when two variables were congruent.

Discussion

Several findings from the present study support those reported earlier by Frase (1969) and Schultz & Di Vesta (1972). One of the fundamental results was that subjects who studied passages organized in some manner (i.e., either by name or attribute) were able to recall more information than those subjects who studied passages without an organizational pattern. Apparently, statements acquire more meaning when they are grouped into what may be called higher order memory units and, as a result are more readily accessible at the time of recall. The fact that more ideas were recalled from organized passages than from unorganized ones is compatible with the notion that organization is an important component of meaning or cognitive structure (Ausubel, 1968).

Higher recall in this instance of organized passages reflects the existence of larger memory units (see, e.g., Tulving & Patkau, 1962).

Another result in this study provided support for the dominance of the name clustering strategy during recall. As indicated by Schultz & Di Vesta, (1972) this preference for the name clustering strategy over the attribute clustering strategy may be due to the history of the learner whose primary experience has been with organization of attributes within broad conceptual categories (i.e., name) which act as subsumers. An alternative explanation, and perhaps more important one from the standpoint of instructional strategy, would suggest that there are fewer names and that their labels are easily discriminated. The attributes, although also six in number, have six values each. Accordingly, all attributes and their respective values comprise a larger (n = 36) set and are not readily discriminated or associated with the appropriate label (or name) without a great deal of experience on the part of the learner. It is apparent that in such learning, the name can be acquired in a one-stage process whereby one name is stored as a discriminable unit from another. Then when the attributes are to be associated with them, the attributes are subsumed as specific entities. However, when attributes are employed as organizing units, the individual who attempts to associate each entity with a name will have 36 independent statements to recall (e.g., Bismania is mountainous; Egrana is a flat plain; etc.). This procedure is certain to produce a great deal of memory strain unless the learner organizes the material into another set of higher order units such as geographical features, modes of transportation, and the like. But even this strategy requires an additional stage in learning compared to the strategy of

learning by name first. It requires the learner to identify the distinctions among names, the structure of the set of attributes, and the values within each set. Because this strategy requires additional effort in the initial stages of learning it is less likely to be adopted immediately (or spontaneously) by the learner.

An especially unique feature of this study was the derivation of a score for intercluster consistency which, in effect, takes into account clustering strategies based on two levels of organization. It appears that such organization is especially important to prose (i.e., connected discourse). For example, the learner first organizes by name and then by attribute within name. Reflected in the data obtained from the subjects in this study, was the finding that there is consistency even in the subordinate levels of organization- that is, when the primary organization was by name, the subject in the later stages of learning also organized the secondary level to retain an order among attributes, from one name to the next. As shown in Table 1, the set of four cells in the present study which were characterized by the highest intercluster consistency were those that were cued by both passage organization and by instructions. The passage that was characterized by the least intercluster consistency was that in which cues were not provided by <u>either</u> treatment. The treatments in which cues were provided either by passage organization <u>or</u> by instructions (but not both) were in between these two extremes. Accordingly, the availability of the hypotheses regarding which strategies facilitate recall affect the degree of both primary and secondary organization.

Of special interest in the present study was the finding that <u>incongruency</u> between passage organization and instructional treatments

facilitated recall of correct statements to a greater extent than did congruency. This finding did not support the initial hypothesis that instructions to employ a given strategy would summate with congruent passage organization to facilitate recall. Nevertheless, these findings can be clearly explained in terms of Restle's (1962) model. He contends that difficulties in cue learning are encountered when the subject employs strategies that conflict with the strategies intended by the experimenter. Such situations are encountered when the subject is given a passage organized according to attribute with no instructions other than those to memorize and, later, to recall the material. The subject then has difficulty because he must now abandon the dominant name strategy. Accordingly, the learning curve data, based on performance of the group that must learn the passage organized by attributes, reflects a gradual change from the strategy of organizing by name to the strategy of organizing by attribute. The gradual adoption of a strategy, where the correct strategy is not clear, differs radically from the rather abrupt and spontaneous adoption by the group instructed to use the appropriate (attribute) strategy. This is a clear replication of one reported earlier by Schultz & Di Vesta (1972). The statement by Johnson, Fishkin and Bourne (1966) that: "... instructions which include explicit labels for stimulus dimensions, which indicate only one dimension will be relevant and which demonstrate a possible solution to a problem all combine to induce a hypothesis-testing type of situation [p. 70]" seems as appropriate to the adoption of a strategy of selecting a basis for organizing connected discourse material as it is to concept learning.

However, the main thesis of Restle's (1962) model is supported in this study by the effect of the interaction between passage organization (i.e., name and attribute only) and instructional treatment (i.e., name and attribute only) on recall, where incongruency appeared to be more facilitative than congruency. Furthermore, it will be recalled that the subjects rated the incongruent conditions as more helpful than the conditions in which the instructional sets coincided with passage organization. These results can be explained on the basis that incongruent instructions tend to define, for the learner, the two fundamental rules for organizing the material to be learned. In fact, by employing these two rules he can form a matrix (and it is likely under the conditions of this particular experiment that he will do so) that would eventually permit him to make application (transfer) to a variety of situations. This conclusion is parallel with one by Hagen, Meacham, and Mesibov (1970) who indicate that "Verbal labels which are imposed externally are irrelevant, and even distracting for the individual who does not utilize them for task performance [p. 57]." In the present task, when a name organization is imposed, the attribute instructions provide supplementary information; similarly, for attribute organization with name instructions. Thus, the two rules are given, one implied in the organization and the other induced by instructions, and consistent with Hagan, Meacham, & Mesibov's (1970) comment is the implication that instructions, as presented in a task involving two dominant strategies, even though superficially incongruent with passage organization, need not be irrelevant unless they cannot be, or are chosen not to be used by the subject when performing the task.

Apparently, the subject found them useful since the data imply that he did use them and, in addition, he rated them as helpful. In actuality, "incongruent" instructions in a task involving two strategies are more informative than congruent ones inasmuch as they exhaust the space that must be scanned by the learner, thereby facilitating his performance as it did in the present experiment.

References

Ausubel, D. P. Educational psychology: A cognitive view. New York: Holt, Rinehart and Winston, 1968.

Frase, L. T. Paragraph organization of written materials: the influence of conceptual clustering upon the level and organization of recall. Journal of Educational Psychology, 1969, 60, 394-401.

Hagen, J. W., Meacham, J. A., & Mesibov, G. Verbal labeling, rehearsal, and short-term memory. Cognitive Psychology, 1970, 1, 47-58.

Johnson, P. J., Fishkin, A., & Bourne, L. E. Jr. Effects of procedural variables on reversal and interdimensional shift performance: Part II. Psychonomic Science, 1966, 4 (2), 69-70. Part I, 63-64.

McNemar, Q. Psychological statistics, New York: Wiley, 1969.

Peterson, L. R., & Peterson, M. J. Short-term retention of individual items. Journal of Experimental Psychology, 1959, 58, 193-198.

Restle, F. The selection of strategies in cue learning. Psychological Review, 1962, 69, 329-343.

Schultz, C. B., & Di Vesta, F. J. The effects of passage organization and note-taking on the selection of clustering strategies and on recall of textual materials. Journal of Educational Psychology, 1971, in press.

Tulving, E., & Patkau, J. E. Concurrent effects of contextual constraint and word frequency on immediate recall and learning of verbal material. Canadian Journal of Psychology, 1962, 16, 83-95.

Summary

Recitation Strategies II: The Effects of a Learner-Sustaining Climate and Encoding on Retention of Facilitators and Debilitators

Charles B. Schultz and Timothy R. Dangel

Technical Problem

Recitation has been found to be a stressful condition which improves retention for some learners (facilitators) and depresses learning for others (debilitators). One reason for the relatively low performance of debilitators may be that they disrupt short-term storage with task-irrelevant thoughts associated with anxiety-producing sitmuli. The debilitative effects of these intrusions may be reduced by minimizing the threat to the learner's self-esteem which is posed by the recitation situation and by requiring the learner to encode instructionally relevant information. It was expected that a learner-sustaining climate and translation of recitation answers would facilitate retention of debilitators compared to a directive climate and verbatim response mode.

General Methodology

Groups of six Ss recited answers to 18 recitation questions asked by E by finding the answers from printed textual material. The Ss were evenly divided between facilitators and debilitators according to the Achievement Anxiety Test. Climate was manipulated by minimizing the evaluative aspect of the recitation exercise for half of the Ss (sustaining) and emphasizing it for the others (directive). Finally,

half the Ss were instructed to translate their answers in the printed material while the remainder were told to make verbatim responses. A 30-item multiple-choice test was given after the recitation period. This test included 18 items based on the answers to the recitation questions (intentional learning) and 12 items based on information included in the printed material but which Ss were not directed to examine (incidental learning). The State Anxiety Test was administered immediately after the recitation period and again after the multiple-choice test.

Technical Results

The sustaining climate was particularly effective in facilitating retention of information which was instructionally relevant, but which Ss were not directed to examine by the recitation questions. The translation response mode was especially effective in improving retention of the answers given to the recitation questions during the experimental "class." The retention scores of debilitators in the sustaining-translation condition were higher than of debilitators in the directive-verbatim condition.

Educational Implications

The present findings can be applied to instructional settings quite directly. Clearly, it is important for instructors to provide opportunities for learners to put the material they study into "their own words." The findings suggest impromptu responding and oral presentations from notes rather than the reading of reports prepared by the student or by others. This is particularly necessary when the learning occurs in moderately stressful conditions such as in the recitation exercise. The maintenance of a learner-sustaining climate facilitates

incidental learning for all students, but is a condition which improves both incidental and intentional learning for debilitators.

Implications for Further Research

The present sutdy could be elaborated upon. Advanced organizers, labels, and other devices to facilitate encoding may also have facilitative effects on the retention of debilitators. Climate variables could also be manipulated. These variables include the use of direct and indirect categories of teacher verbal behavior which are important components of many instruments used in systematic observation of classroom verbal behavior.

Recitation Strategies II: The Effects of a Learner-Sustaining Climate and Encoding on Retention of Facilitators and Debilitators[1]

Charles B. Schultz and Timothy R. Dangel

A relatively large proportion of instruction is given to recitation exercises (Gall, 1970; Hoetker and Ahlbrand, 1969). At least two important elements of recitation techniques, questions and speaking before a gorup, have been found to be stressors which create anxiety (Kubis, 1948; Zajonc, 1966). However, all learners may not benefit equally from stress produced by recitation. Persons characterized as facilitators by the Achievement Anxiety Test (Alpert and Haber, 1960) retained more from reciting than debilitators, whose retention decreased as the rate of recitation increased (Schultz, 1970). The relatively poor performance of debilitators may be due to their tendency to "overload" short-term storage with intrusions of irrelevant thoughts associated with anxiety (Sarason, et al., 1960). In the case of recitation, these intrusions may include thoughts brought on by the learner's anticipation of being called upon to recite and by his relief after reciting or not being called upon.

The purpose of the present experiment is to identify instructional treatments which reduce the debilitating effects of intrusions created by recitation. One possible treatment is to minimize the threat to

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[1] The authors acknowledge the assistance of the students and administration of the Altoona High School, Altoona, Pennsylvania. In particular, they are indebted to the gracious cooperation extended by Mrs. Grace Epright, Head Guidance Counselor.

self-esteem posed by recitation and thereby make the occurrence of intrusions less likely. Presumably, the threat to self-esteem is intensified when the learner feels his actions are being evaluated and reduced when evaluation is minimal. Accordingly, intrusions may be directly related to the extent to which the learner is "put on the spot" in the recitation situation. For the purposes of the present research, it was assumed that a sustaining instructional climate which was designed to support the learner is less of a threat to self-esteem than a directive climate which was designed to emphasize the evaluation of the learner by peers and an authority.

It also may be possible to override the disruptive effects of intrusions which do occur by requiring the learner to encode instructionally relevant information. Encoding, transforming input, or otherwise relating new responses to existing elements in the learner's cognitive structure is necessary to transfer information from short-term memory store to long-term storage (Atkinson and Shiffrin, 1968). One way of requiring encoding is to have the learner put the answer in his own words. As a consequence of translating, the learner must relate the new response to existing elements in his cognitive structure. Thus, the act of translation may require processing information so it is transferable to and retrievable from long-term storage. On the other hand, verbatim repetitions emphasize rehearsal rather than encoding and are, thereby, more subject to decay and the disruptive effects of intrusions.

Based on this rationale, a major expectation of this study is that translation in a sustaining climate facilitates retention of debilitators compared to debilitators in other conditions.

Method

Design

Each S in a group of six responded to three recitation questions by finding and reciting answers from printed textual material. Half of these Ss were selected as facilitators based on their extreme scores on the Achievement Anxiety Test (Alpert and Haber, 1960) while the remainder were judged as debilitators. Climate was varied by emphasizing or minimizing the evaluation of the Ss responses before the group and by withholding or offering praise after each response. These manipulations were designed to produce a directive or a sustaining climate. Half of the Ss in each climate condition were instructed to make verbatim responses while the remainder were told to translate the answers into their own words. These manipulations imply a 2 x 2 x 2 factorial analysis of variance design with two levels of climate (directive and sustaining), two levels of response mode (verbatim and translation), and two personality types (debilitators and facilitators).

Subjects

The Ss were 72 seniors from a local high school who were drawn from a larger pool of students who took the Anxiety Achievement Test (AAT). Two groups were defined by their extreme scores on the AAT as follows: debilitators were high scorers on the debilitating scale ($\overline{X}$ = 34.17) and low scorers on the facilitating scale ($\overline{X}$ = 19.33) while facilitators were low scorers on the debilitating scale ($\overline{X}$ = 20.79) and high scorers on the facilitating scale ($\overline{X}$ = 29.42). Three facilitators and debilitators were randomly assigned to the recitation sessions. When

students who were randomly assigned to an experimental session were unavailable due to absence or scheduling conflicts, other students were assigned to take their place. The scores of these "fillers" were not included in the analyses. The missing students were reassigned to a later session.

Experimental Materials

The experimental materials were identical to those used in an earlier study (Schultz, 1970). Briefly, they consisted of a set of 36 slides each of which contained a sentence or brief paragraph which described an experiment on attitude change. Printed versions of the slides were used by Ss to identify answers to 18 recitation questions asked by E. These questions were factual in nature and easily answered from the printed material.

Procedures

The experiment was described to S as a lesson with three parts: a brief slide presentation, a recitation period in which S would search for and recite answers to questions asked by E, and a test on the information presented during the experimental lesson. During the first stage, 36 slides were projected at eight second intervals providing only enough time for rapid scanning of their contents. The slides contained a modified description of the Festinger and Carlsmith (1959) study of the cognitive effects of forced compliance. The original version was modified to make it more understandable to high school students. Printed versions of the slides were then distributed for use during the recitation period. Before the recitation period, Ss received instructions designed to induce the experimental conditions.

Treatments. The purpose of the directive climate was to emphasize the evaluation of the learner during recitation. These Ss were instructed as follows:

> It is important that you understand why you are reciting in this lesson. The reason we are asking you to recite is to find out whether you know or at least can find the right answer. You'll help us by making sure your answer is correct.

The sustaining treatment was designed to minimize the evaluation of the learner during recitation. These Ss were instructed as follows:

> It is important that you understand why you are reciting in this lesson. The reason we are asking you to recite is not to find out whether you know or can find the answer, but just to share your answer with the others and to make sure every one gets the same answers. You'll help us by sharing your three answers with the rest of the group.

Each correct answer given by Ss in the sustaining condition was verbally reinforced by E who responded with, "Good," "Right," "That's it," etc. When a correct answer was given by Ss in the directive condition, E merely went on to the next recitation question. In both conditions, when S made an error, he was asked to reexamine the printed material.

The climate conditions were orthogonally crossed with the two modes of response treatments. Half of the Ss in each climate condition were given verbatim instructions. They were told to repeat the answers in the same words as the printed material without making any changes. The rest were given translation instructions to the effect that they must rephrase the answers in their own words rather than to repeat them as they were in the printed material.

Measures. After the recitation period, the first ten items of the State Anxiety Test (Spielberger, Gorsuch, & Lushene, 1968) were administered. The test was represented as a "Self-Evaluation Questionnaire" in which Ss were to describe how they felt during the recitation period. Retention was measured with a 30 item multiple-choice test which provided indicies of intentional learning (information included in answers to recitation questions), incidental learning (information not recited but included on the slides and printed material), and recitation learning (answers to the questions S recited). Before giving the test, E attempted to reduce anxiety posed by the test so that any differences which were obtained could be attributed to the recitation period. They were given the following instructions:

> This is more a test of different teaching techniques than it is of you. Unlike the recitation period where everyone could see how well you did, your individual test score will not be known to others and is of no interest to us. Your score will be only one of many that are averaged together and lost among other scores.

After the test, Ss completed items 11 through 20 of the State Anxiety Test, this time using the completion of the multiple-choice test as a reference point.

Results

The first ten items in the State Anxiety Test were used to determine whether the climate conditions were induced. The analysis of variance of scores derived from these items yielded F (1,64) = 1.25, $p > .05$ for the effect due to climate. Although this difference was not significant, the mean score of the sustaining condition ($\bar{X}$ = 18.75) was lower than that of the directive condition ($\bar{X}$ = 20.03). Thus, the

direction of the means was suggestive of induction. A similar analysis of State Anxiety yielded $\underline{F} < 1.0$ for the effect due to response mode. The verbatim response mode ($\overline{X} = 19.36$) differed little from the translation condition ($\overline{X} = 19.41$). While deficiencies in response mode were not reflected in differences in anxiety, personality differences were. An analysis of variance yielded $\underline{F}\ (1,64) = 14.36$, $\underline{p} < .001$ in which facilitators ($\overline{X} = 17.31$) reported less anxiety than did debilitators ($\overline{X} = 21.47$).

The last ten items of the State Anxiety Test were administered immediately after the multiple-choice test. The purpose of this administration was to determine whether any differences in retention which were obtained between the experimental conditions were due to the effects of stress produced by recitation or to stress produced by the test itself. No differences were obtained between the sustaining ($\overline{X} = 19.25$) and directive climate ($\overline{X} = 19.64$) or between the verbatim ($\overline{X} = 19.75$) and translation ($\overline{X} = 19.14$) response modes. An analysis of variance of scores from these items yielded $\underline{F} < 1.0$ for the effect due to both climate and response mode treatments. An analysis of the effect due to personality yielded $\underline{F}\ (1,64) = 24.34$, $\underline{p} < .001$, in which facilitators ($\overline{X} = 16.80$) once again reported less tension than debilitators ($\overline{X} = 22.09$). These findings suggest that differences in retention due to climate may be the result of stress from the recitation period, but do not appear to be due to the stress associated with test-taking. On the other hand, it is not clear whether any main effects in retention obtained between facilitators and debilitators would be due to stress from recitation of from the test situation.

In addition to the overall retention score, three sub-scores of that measure were also analyzed. These included intentional learning, incidental learning, and the learning of answers to items S personally recited. An analysis of variance of overall retention score yielded F (1,64) = 2.92, $p < .09$ for the effect due to climate, F (1,64) = 2.30, $p < .13$ for the effect due to response mode, and F (1,64) = 2.50, $p < .12$ for the effect due to personality. For each analysis, the effects were above traditionally accepted levels of significance ($p = .05$) but in each case, the means were in the expected direction. The sustaining scores ($\bar{X} = 14.63$) were higher than the directive scores ($\bar{X} = 13.17$), translation ($\bar{X} = 14.56$) higher than verbatim ($\bar{X} = 13.25$), and facilitation ($\bar{X} = 14.58$) higher than debilitators ($\bar{X} = 13.22$).

Scores on items which tested intentional learning were analyzed for the effect of climate, response mode, and personality. The effects of both climate and personality were not significant (F [1,64] = 1.89, $p > .10$ for the effect due to personality and $F < 1.0$ for the effect due to climate). A similar analysis yielded F (1,64) = 3.88, $p < .05$ for the effect due to response mode. Retention scores of the translation group ($\bar{X} = 8.94$) were higher than those of the verbatim group ($\bar{X} = 7.67$). The multiple-choice test included 12 items which tapped incidental learning, i.e., they required information included on the printed material, but which Ss were not directed to examine by the recitation questions. An analysis of variance of incidental learning yielded F (1,64) = 5.18, $p < .03$ for the effect due to climate. Retention for the sustaining group ($\bar{X} = 6.09$) was higher than for the directive group ($\bar{X} = 5.11$). Neither the response mode nor personality effects were significant ($F < 1.0$).

A further analysis was made to determine how well S retained answers to questions they personally recited in the experimental "class." It will be recalled that each S responded to only three questions and that a different random assignment of questions was made for each experimental session. This analysis yielded F (1,64) = 4.88, $p < .03$ for the effect due to response mode, in which retention by the translation group ($\bar{X} = 2.03$) was greater than by those who made verbatim repetitions ($\bar{X} = 1.56$). A similar analysis yielded F (1,64) = 2.85, $p < .10$ for the effect due to personality. Facilitators ($\bar{X} = 1.97$) retained more than debilitators ($\bar{X} = 1.61$). The effect due to climate yielded $F < 1.0$.

An earlier study (Schultz, 1970) found that facilitators scored higher than debilitators on measures of intentional and incidental learning. The differences in overall retention in the present study were consistent in their direction, but marginal in magnitude. Since the directive-verbatim (DV) condition was closest to that of the earlier experiment, a pairwise comparison of overall learning was made between facilitators and debilitators in that group. This analysis yielded t (64) = 1.16, $p > .10$ for the effect due to personality ($\bar{X} = 13.56$ for facilitators and $\bar{X} = 11.56$ for debilitators). An analysis of incidental learning yielded t (64) = 1.97, $p < .05$ for the effect of personality in which facilitators ($\bar{X} = 5.44$) scored higher than debilitators ($\bar{X} = 4.67$).

The primary concern of the present experiment was with the retention of debilitators. It was hypothesized that both a sustaining climate and translation would improve their retention. In order to test this hypothesis, a separate analysis was made of the retention scores of

debilitators in a 2 x 2 factorial analysis of variance design with two levels of climate and two levels of response mode. The results can be summarized as follows: (1) The analysis of overall learning scores yielded $\underline{F}$ (1,32) = 2.10, $\underline{p}$ < .16 for the effect due to climate and $\underline{F}$ (1,32) = 2.38, $\underline{p}$ < .13 for the effect due to response mode; (2) the analysis of intentional learning yielded $\underline{F}$ < 1.0 for the effect of climate and $\underline{F}$ (1,32) = 3.27, $\underline{p}$ < .08 for the effect due to response mode; and (3) the analysis of incidental learning yielded $\underline{F}$ (1,32) = 5.19, $\underline{p}$ < .03 for the effect due to climate and $\underline{F}$ < 1.0 for the effect due to response mode. The means used in this analysis are summarized in Figure 1 where it may be seen that both a sustaining climate and translation facilitate retention for debilitators. However, the beneficial effects of a sustaining climate on the retention of debilitators is felt primarily on incidental learning while the effect of response mode is primarily on intentional learning.

One implication of the present hypothesis is that the greatest differences in retention among debilitators would occur between the ST condition where both remedial treatments were experienced and the DV condition where neither treatment was experienced. The direction of the means, summarized in Figure 1, is consistent in this regard. Of the four cells containing debilitators, scores of the ST group are highest and those of the DV group the lowest on each measure. A pariwise comparison of the ST and DV debi litators yielded $\underline{t}$ (32) = 2.12, $\underline{p}$ < .05 for overall learning. As represented in Figure 1a, retention of debilitators in the ST condition is not only superior to that of other debilitators, particularly those in the DV condition,

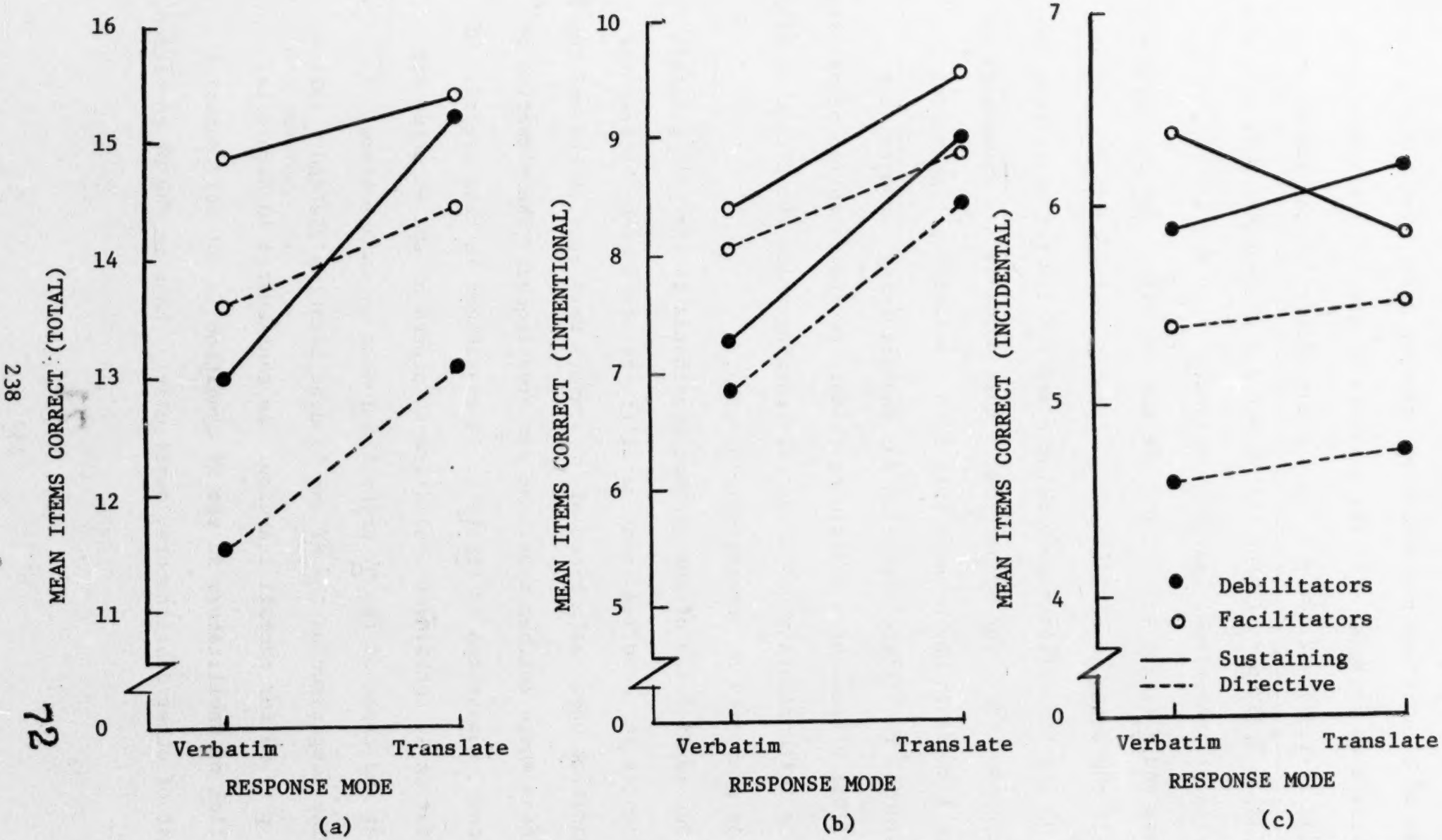

Figure 1. Performance of facilitators and debilitators in two response mode and climate conditions on measures of retention.

it approximates the retention of facilitators. The same trend was obtained in pairwise comparisons of retention sub-scores. These analyses yielded t (32) = 1.68, $p < .05$ (one-tailed) for intentional learning and t (32) = 1.97, $p < .05$ (one-tailed) for incidental learning.

Discussion

Both climate and response mode are variables which clearly have important effects on retention in recitation settings, particularly for persons classified as debilitators. Although the sustaining climate resulted in moderately higher overall retention scores than the directive climate, its most pronounced effect was to facilitate incidental learning. This finding is important for instructional purposes because teachers typically require or encourage learning beyond the target information to which they explicitly direct their learners.

The superior incidental learning of the sustaining group may have been due, in part, to the reduced ego threat they experienced. As a result they were less concerned with committing errors and, therefore, free to "stray" from the instructor's definition of the content. On the other hand, Ss in the directive condition may have felt compelled to restrict their learning to the recitation questions. In some regards, questions inserted before relevant textual material function as the written counterparts of recitation questions. Frase's (1970) review of the effects of pre-questions in textual material suggests that, in general, they depress incidental learning. However, the tendency of pre-questions to produce greater selectivity in learning was overcome under conditions of high motivation (financial payment was used as an

incentive). Thus, another factor which may contribute to the higher incidental learning by the sustaining group in the present experiment is the motivational effect of E's verbal reinforcement which may have been comparable to the incentive of modest financial payment used in the studies Frase reviewed.

As might be expected, translation had little effect on incidental learning. However, translation appears to be an important variable influencing how much is retained of the information S personally recites (recitation learning) as well as influencing how much information recited in "class" by others (intentional learning) is retained. To maximize transfer from short-term to long-term storage, it appears to be important to go beyond rehearsal (verbatim responses) and to require the learner to relate new information to previously acquired information. Presumably, translation is one way of ensuring encoding and, thereby, the transfer of information to long-term storage where it is maintained and retrievable.

The performance of debilitators in the ST condition was of particular interest. The findings support the hypothesis that translation in a sustaining climate improves retention of debilitators compared to other debilitators who received no remedial treatment. The direction of the means of debilitators in the four treatment conditions was consistent across all measures of retention. Those of the ST treatment were invariably the highest while those of the DV group, which received no remedial treatments, were the lowest. Although these findings do not explain the hypothesis that short-term storage is vulnerable to disruption from irrelevant thoughts, they are consistent with it. Presumably, a sustaining climate reduces the number of intrusions and

encoding mitigates the effects of those intrusions which do occur. In this regard, encoding functions in the recitation setting as Sieber, Kameya, and Paulson (1970) found memory supports to function with a problem-solving task. In both cases, the disruption of short-term memory which debilitators appear to be particularly susceptible to is overcome.

The main effect of personality type (facilitators or debilitators) is less clear than the effect of either climate or response mode. The differences in retention of very moderate magnitude which were obtained may have been due to the debilitative effects of stress induced by test-taking as well as by reciting. The contribution of each to the differences in retention which were obtained is not clear from the present analyses. Moreover, the relatively large differences in retention between facilitators and debilitators obtained in an earlier study (Schultz, 1970) were not found in the present research. The failure to replicate earlier findings may be accounted for in part by the facilitative effect of translation and a sustaining climate on the retention of debilitators.

The findings of the present experiment, together with those of an earlier study (Schultz, 1970), permit the following conclusions regarding recitation strategies: (1) More of the instructional topic is retained when learners do not know when they will be called upon to recite than when their turn is known, (2) Moderate rates of reciting result in greater retention than frequent reciting, (3) Facilitators learn more from reciting than debilitators, (4) A sustaining climate facilitates retention, particular of incidental learning compared to a directive climate, (5) Translation facilitates retention, particular of

intentional learning compared to verbatim responding, and (6) Translation in a sustaining climate improves intentional and incidental retention of debilitators compared to those who experience a directive climate and a verbatim response mode.

References

Alpert, F., & Haber, R. N. Anxiety in academic achievement situations. Journal of Abnormal and Social Psychology, 1960, 61, 207-215.

Atkinson, R. C., & Shiffrin, R. M. Human memory: A proposed system and its control processes. In Spence, K. W., and Spence, J. T. (Eds.), The psychology of learning and motivation: Advances in research and theory. Vol. 2. New York: Academic Press, 1968.

Festinger, L., & Carlsmith, J. M. Cognitive consequences of forced compliance. Journal of Abnormal and Social Psychology, 1959, 58, 203-210.

Frase, L. T. Boundary conditions for mathemagenic behaviors. Review of Educational Research, 1970, 40, 337-347.

Gall, M. D. The use of questions in teaching. Review of Educational Research, 1970, 40, 707-721.

Hoetker, J., & Ahlbrand, W. P. The persistence of recitation. American Educational Research Journal, 1969, 6, 145-167.

Kubis, I. F. Adaptation of the psychogalvanic response to a visual, auditory, and ideational stimulus. American Psychologist, 1948, 3, 256.

Sarason, S. B., Davidson, K. S., Lighthall, F. F., Waite, R. R., & Ruebush, B. K. Anxiety in elementary school children. New York: Wiley, 1960.

Schultz, C. B. Recitation strategies: The effects of rates and schedules of verbal responses on retention. In F. J. Di Vesta, D. R. Peters, N. M. Sanders, C. B. Schultz, and P. D. Weener. Instructional strategies: Multivariable studies of psychological processes related to instruction. A semi-annual report to the Advanced Research Projects Agency, Order Number 1269, January, 1970.

Sieber, J. E., Kameya, L. I., & Paulson, F. L. The effect of memory supports on the problem-solving ability of test-anxious children. Journal of Educational Psychology, 1970, 61, 159-168.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. The state-trait anxiety inventory. Tallahassee, Florida: Psychology Department,

Zajonc, R. B. Social psychology: An experimental approach. Belmont, California: Wadsworth, 1966.

The Effects of Subjective Organization Instructions and Verbal Creativity On the Recall of Random and Organized Lists

Paul Weener and Ovid Tzeng

When faced with the task of remembering many separate bits of verbal information, prople tend to group or cluster the bits into subjective units or clusters. The semantic, syntactic, and phonemic features which define words are of such a number that almost any set of "unrelated" words or grapheme units can be partitioned into subsets within which items share a number of features (Bower, 1970). Verbal learning studies have shown that the dominant strategy of subjects in free recall tasks is to create word clusters and to use these clusters as recall units (Bousfield, Puff, & Cowan, 1964; Tulving, 1962).

In instructional settings, students impose organization on verbally presented material regardless of whether or not that material has been preorganized by the instructor or a textbook. The student makes use of the organizational features of the material which have been taught to him and are shared in common by his cultural or scientific community. In addition, the student adds unique organizational features as well. In this sense, subjective organization can be thought of as consisting of two components, (a) the normative, or common component which is imposed by the textbook or instructor and (b) an idiosyncratic component which is based on a given individual's unique structuring response to the material. The "meaning," or structural relations, among the

elements of information has a component which is common to all the people in a given social community because of the common experiences and uses which members of the same culture have with these elements. In addition to this common component is an idiosyncratic component which reflects the unique idiosyncratic experiences, contexts, and uses with which the elements to be learned have been associated.

It can be argued that students will learn best when they are free to impose their own organizational schemes on material to be learned. Mandler & Pearlstone (1966) found that subjects in a free organization group took half as many trials to obtain stable groupings of 52 "unrelated" words when compared to a constrained group which was required to use the groupings provided by subjects in the free organization group. Deagman (1969) showed a similar effect in a free recall task using three different kinds of word lists. Subjects who were free to group the words freely on a sorting board later recalled more words than those subjects who were constrained to use the categories which were used by the subjects in the free organization group. This was true for word lists which had high and moderately salient conceptual categories built into the lists and for a list of randomly selected words.

Subjective organization can be viewed as a mathemagenic behavior, involving all three aspects of mathemagenic behavior as described by Rothkopf -- translation, segmentation, and processing. Rothkopf's disillusionment with the "calculus of practice" approach to the study of instruction resulted in his statement of a "practice indeterminacy principle": "A particular, objectively described practice event can

result in several different psychological states" (1968, p. 112). The research in subjective organization emphasizes these differences in psychological states and attempts to describe their effects.

The purpose of the present study is to investigate the effects on learning of imposing constraints on a subject's freedom to categorize words. It is hypothesized that the facilitative effects of free organization activities will be greater for unstructured word lists than for word lists which have "built-in" normative categoreis. The rationale for this hypothesis is that unstructured word lists provide greater opportunity for a person to employ subjective organizational strategies. Word lists which consist of highly common sub-categories of words should be organized similarly for most subjects, and the negative effects of being forced to use another person's categorization scheme should be less in such instances than in situations which produce highly idiosyncratic word groupings. The study was also designed to investigate the relationship between a measure of verbal creativity and recall under the different experimental conditions.

Method

Design

The study was carried out as 3 x 2 factorial design with organizational mode and the category saliency of the stimulus word lists defining the two factors. The three organizational modes were (a) free, (b) constrained, and (c) constrained random, and the word lists were classified as high and low saliency.

Subjects

Sixty-six subjects from the introductory educational psychology course participated in the experiment. They were awarded points toward their final course grade for participation in the experiment.

Materials

Two sets of 40 stimulus words were constructed. The list of high category saliency words were selected from the norms provided by Battig & Montague (1969). These norms were constructed by asking 442 subjects to give as many specific responses to a generic category label as they could in a 30-sec. period. Eight words were selected from each of five categories from responses which were given by at least 10 subjects. The five categories used were (a) a type of footgear, (b) a weapon, (c) a carpenter's tool, (d) a natural earth formation, and (e) a part of a building. The low category saliency list of 40 words was then constructed by selecting paired words from the Thorndike and Lorge (1959) general word count which matched the words in the high saliency list for frequency, number of syllables, and first letter. All words in both lists were nouns.

The Remote Associates Test (RAT) was developed to measure "the ability to think creatively" (Mednick & Mednick, 1967). The theory on which the test is based describes the creative thinking process "as one of seeing relationships among seemingly 'mutually remote' ideas and forming them into new associative combination" (p. 1). A subject is required to supply a response word which has some association with each of three stimulus words, e.g., "scotch" is the correct response to the three stimulus words, "soda," "kilt," and "butter." Alternate form

reliability reported by Mednick & Mednick (p. 13) was .81 based on a sample of 71.

Procedure

Subjects were randomly assigned to one of the six experimental conditions and participated individually in the experiment. After being seated at a table, they were instructed to put on a set of headphones and that all instructions were taped and would be presented through the headphones. In front of the subject on the table was a 36" x 27" piece of cardboard ruled into nine equal rectangles. A pack of 40 plain 3" x 5" cards with one word per card were placed face down on the cardboard. The high and low category saliency groups differed only in the words which were printed on the cards.

The taped instructions for the free organization group were as follows:

> The experiment you are about to participate in investigates how people organize and recall verbal materials. Forty 3 x 5 cards are face down on the table in front of you. On each card is written one word. Your job will be to turn the cards over one at a time, pronounce the word out loud, and place the card in one of the spaces or the sorting board. Place the words which seem to go together in the same space on the sorting board. You can use as many of the spaces as you wish. You can use any grouping of the words which will help you remember the words, except - do not group the words alphabetically, but rather group the words based on the meaning of the words.
>
> You will turn the cards over one at a time and have 5-secs. to place the word on the sorting board. After you start a bell will ring every 5-secs. to pace your work. Every time the bell rings you must place a card on the sorting board and pick up a new card. After all the cards have been placed, you will be given another set of cards which contain the same 40 words in a different order. You will sort them once again following the same procedure. After the second sorting, you will be asked to write down as many of the words as you can. Remember, sort the words into meaningful categories which will help you to remember the words.

The constrained and constrained random group followed a similar procedure but in both of these conditions a number from 1 to 9 was written in the upper right hand corner of the card corresponding to numbers written in the 9 spaces on the sorting board. Each subject in the constrained group was yoked to a subject in the free organization group. The number on the card corresponded to the space in which that word had been sorted on the second trial by the yoked subject in the free organization group. In the constrained random group, the number of categories and the number of words per category were the same as the yoked subject but the words were assigned at random within each category. The instructions to these two groups were the same and the procedure was similar to the gree organization group. The significant part of the instructions which distinguished the two constrained groups from the free group was as follows:

> Your job will be to turn the cards over one at a time and pronounce the word out loud. Then look at the number written on each card and place the card on the sorting board in the category with the same number. Try to make some sense out of the groupings of words so that you can remember the words better.

After a subject had sorted the deck for the second time, he was asked to write down as many words as he could on a recall sheet. The 8 1/2" x 11" recall sheet was marked off into nine rectangles like the sorting board. All subjects were instructed: "Try to write the words into the same groupings that you used when you sorted them." They were given five minutes for recall. Following recall, the Remote Associates Test was administered following standard procedures with a 30 minute time limit.

Results

A 3 x 2 analysis of variance was carried out to determine the effects of organizational mode and type of word list. The means and standard deviations for number of words recalled in each of the six conditions is presented in Table 1.

The main effect due to organizational mode was significant, F (2,60) = 31.9, $p < .001$. The main effect due to word lists was not significant, F (1,60) = 3.45, $p > .05$, and the interaction between organizational mode and type of word list was not significant, F (2,60) = 1.28, $p > .05$. A Scheffe's test on the three means for the different organizational modes indicated that all three means were significantly different from each other ($p < .05$).

An aptitude-treatment interaction was hypothesized between verbal creativity and the organizational mode. In order for this hypothesis to be supported, the correlations between verbal creativity and number of words recalled would be different for the treatment conditions. The results of the correlation and regression analysis are presented in Table 2.

A test of the aptitude-treatment interaction hypothesis was carried out by testing the null hypothesis that the three regression slopes were equal (Cronbach & Snow, 1969). The null hypothesis was not rejected, f (2,60) = 1.74, $p > .05$. Although the differences in the regression slopes were not significant, the correlation between RAT performance and recall was significantly different than zero in the constrained-random group. The correlation between number of words recalled and RAT score was -.04 for the combined free organization and

Table 1

Means and Standard Deviations for Number of Words Recalled

Word List		Organizational Mode: Free	Constrained	Constrained Random
High Saliency	$\bar{X}$	27.00	23.82	16.45
	SD	3.10	4.91	3.14
Random Saliency	$\bar{X}$	24.09	21.18	16.82
	SD	2.88	4.53	3.52

Table 2

Means and Standard Deviations of RAT Scores and Correlation and Regression Coefficients of RAT Scores with Number of Words Recalled

	Organizational Mode: Free	Constrained	Constrained Random
Remote Associates Test			
$\bar{X}$	14.32	13.46	14.18
SD	4.97	4.48	4.71
r	-.05	-.11	+.48*
b	-.03	-.11	+.33*

*$p < .05$

constrained group. These are the two groups which sorted the words into meaningful categories. When the correlation between RAT scores and recall performance for this combined group is compared to the same correlation for the random constrained group, a significant difference results, $z = 2.00$, $p < .05$.

Discussion

The results indicated that subjective organization of independent bits of information facilitated recall of that information. The facilitative effects were similar when the stimulus words contained salient categories and when they were randomly selected. It had been hypothesized that the effects of the different organizational modes would be greater for the randomly selected word lists than for the lists in which the categories were salient. This was based on the expectation that subjects in the high saliency condition would utilize the provided category groupings with a resulting small idiosyncratic component in the resulting word groupings, and that subjects in the random word list condition would have a large idiosy ncratic component in their word groupings. The larger the idiosyncratic component in the word groupings formed by subjects in the free organization condition, the less "helpful" the imposed word groupings would be for the yoked subjects in the constrained condition. What seemed to happen, however, is that the categories which were created by the free organization subjects from the random word list condition were as "helpful" to the yoked subjects as the categories created in the high saliency word list. The helpfulness of the imposed organization can be attested to by comparing the constrained to the constrained random group. Using someone

else's grouping of the words resulted in considerably greater (32% more) recall than using the random groupings provided. The constrained and constrained random group followed identical experimental procedures so that the difference in recall can be attributed to the characteristics of the word groupings that they were constrained to work with in the sorting task.

The lack of a significant effect due to category saliency in the word lists was somewhat surprising. The variance accounted for by organizational mode was much greater than the variance accounted for by the categories which were or were not available in the word lists. Even though the words were selected randomly for the random word lists, subjects found meaningful categories of words imbedded in the list. These categories which subjects imposed on the random lists had sufficient inter-subject meaning to produce the large observed effect between the constrained and the constrained random group.

The differences among the three groups in the correlation between RAT score and number of words recalled seems to indicate a differential treatment effect. The RAT is designed to measure the ability to see "relationships among seemingly 'mutually remote' ideas and forming them into new associative combinations" (Mednick & Mednick, 1967, p. 1). The task for the constrained random group requires just such an ability. A person who scores high on the RAT shoulc be able to perform better on a task in which word groupings are random, because such a person can form "new associative combinations" which will facilitate recall. In both the free organization and constrained organization group, the subject sorted the words into meaningful categories and thus the opportunity to utilize the abilities measured by the RAT are less available.

One possible implication of this finding is that some students require more pre-structuring of instructional materials than other students require. The RAT may be an appropriate measure of the relevant individual difference when the instructional materials are verbal.

The findings however do not support a differential treatment procedure. The regression lines relating RAT scores and recall do not cross; the free organization treatment is better than the constrained treatment which is better than the constrained random treatment in a free recall task for all levels of RAT. The differences in correlations implies that in an unstructured random verbal task, verbal creativity is correlated with recall performance whereas in a situation where the verbal materials are more organized, verbal creativity is not correlated with recall performance. Unstructured tasks, such as that presented to the random-constrained gorup, tended to "penalize" subjects with low RAT scores more than it "penalized" subjects with high RAT scores.

References

Battig, W. F., & Montague, W. E. Category norms for verbal items in 56 categories. Journal of Experimental Psychology Monograph, 1969, 80, No. 3, Pt. 2.

Bousfield, W. A., Puff, C. R., & Cowan, T. M. The development of constancies in sequential organization during repeated free recall. Journal of Verbal Learning and Verbal Behavior, 1964, 3, 489-495.

Bower, G. Organizational factors in memory. Cognitive Psychology, 1970, 1, 18-46.

Cronbach, L. J., & Snow, R. E. Individual differences in learning ability as a function of instructional variables. Final report to U. S. Office of Education. School of Education, Stanford University, 1969.

Deagman, G. K. The effects of organizational mode and category saliency on the recall of verbal materials. Unpublished master's thesis, The Pennsylvania State University, 1969.

Mandler, G., & Pearlstone, Z. Free and constrained concept learning and subsequent recall. Journal of Verbal Learning and Verbal Behavior, 1965, 5, 126-131.

Mednick, S. A., & Mednick, M. T. Remote Associates Test. Boston: Houghton Mifflin, 1967.

Rothkopf, E. Two scientific approaches to the management of instruction. In Learning Research and School Subjects, Gagne, R., & Gephart, W. J. (Eds.). Itasca, Illinois; Peacock, 1968.

Thorndike, E. L., & Lorge, I. Teacher's word book of 30,000 words. New York: Teachers College, Columbia University, 1959.

Tulving, E. Subjective organization in free recall of "unrelated" words. Psychological Review, 1962, 69, 344-354.